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Abstracts from the 2004 Meeting of the British Trauma Society

Management of peri prosthetic femur fractures. Are plating systems the answer?

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Aim: To study the outcome of peri prosthetic femur fracture management in Vancouver type B and C fractures, using Dall Miles Cable plate system and Mennen plate system.

Method: Thirteen patients with 14 per-prosthetic femur fractures of only Vancouver type B and type C were treated with either of the plate systems between January 1998 and July 2003.

Vancouver type A fractures were excluded from the study to relative stability of the fracture around the prosthesis.

Outcome: Out of eight cases of B1 type of fractures, two failed through loss of reduction and resultant delayed/non union requiring further surgical treatment.

Out of four cases of B2 type of fractures, one failed once again due to failure of implants to hold fracture till union is achieved.

Out of two cases of type C fractures, both had further fractures below the tip of the plate in highly osteoporotic bones, requiring refixation.

Dall Miles or Mennen plate systems used alone is insufficient treatment for periprosthetic femur fractures in elderly patients with poor bone quality.

An audit of the use of the abbreviated mental test score in patients with fractured neck of femur—do orthopaedic SHO's understand its importance and can they perform it adequately?

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Several studies have shown that the mental state of patients with fractured neck of femur is important as the main predictor of post-operative outcome and as a baseline for in-patient monitoring of changes in mental state. The abbreviated mental test score (AMTS) is a validated and simple tool that can be used to good effect for the assessment of pre-operative mental state in patients with fractured neck of femur. This audit investigated whether or not Orthopaedic SHOs appreciated the importance of mental state assessment in patients with fractured neck of femur and whether they were able to carry it out satisfactorily using the AMTS.

Seventy on-call Orthopaedic and Trauma SHOs from around mainland Britain were randomly contacted by telephone and asked questions from a standard questionnaire. On average, only 5 out of the 10 standard questions on the AMTS were correctly identified. Only half of the SHOs could satisfactorily explain the importance of mental state assessment in patients with fractured neck of femur.

Patients with fractured neck of femur and low AMTS have higher morbidity and mortality, and this should be identified early so that their care can be optimised. This audit has shown that Orthopaedic SHOs should be better informed and educated as to the use of the AMTS. We identified numerous, serious implications including medical management issues and the accurate local and regional use of the AMTS as an audit tool.

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Reaming during anterograde femoral nailing: is it worth it?

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The use of reaming during femoral nailing remains controversial. A systematic review was performed to assess the relative merits of reamed and unreamed antegrade femoral nailing. To be included, a study had to be prospective, randomised or pseudorandomised, comparing reamed and unreamed antegrade femoral nailing in adults. Where more than one study from the same institution was available, only the study with longest follow-up was included. A search of Medline (1966 onwards) and the Cochrane database found 2044 possible articles. Of these, eight studies compared reamed and unreamed femoral nailing. The methodology of these articles was independently assessed by all three authors. There was good agreement between authors (kappa = 0.83). Five studies met the inclusion criteria. Data was collected from these studies by all three authors. Any disagreements were resolved by consensus. Each outcome measure tested was assessed for heterogeneity using the Cochran *Q*-test. If significant heterogeneity was present ($p < 0.10$), data from the studies was not combined and the studies were examined for possible explanations. If there was no significant heterogeneity, a combined odds ratio or weighted mean difference was calculated using a fixed effects model and a *Z*-test was performed to test the overall effect.

Six hundred and forty-seven femoral fractures (315 reamed; 332 unreamed) were entered into the included studies. Only seven patients were lost to follow-up. Unreamed nailing was quicker and associated with significantly less blood loss ($p < 0.00001$). Reaming significantly reduced the time to union ($p = 0.00001$), nonunion ($p = 0.002$), delayed union ($p = 0.005$), technical problems ($p = 0.01$) and reoperation rate ($p = 0.001$). There was no difference in terms of infection or implant failure. There were two deaths in the unreamed group, one after a pulmonary complication. There were no deaths or pulmonary complications in the reamed group. The use of reamed femoral nails gives significant advantages over unreamed femoral nails.

Functional outcome of burst fractures of the first lumbar vertebra managed both surgically and conservatively

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Introduction: The thoracolumbar spine is the most common site for vertebral column injuries and the management of thoracolumbar burst fractures is controversial.

Aim: To assess functional outcome in patients treated surgically or conservatively following burst fractures of L1.

Methods: A retrospective review of 31 neurologically intact patients with burst L1 fractures. Follow-up clinical evaluation obtained from 26 patients, 11 treated surgically and 15 managed conservatively. Patients assessed with regard to pain, employment status, recreational activities and overall satisfaction with treatment.

Results: At final clinical follow-up of 15 patients managed *conservatively*, 6 had little/no pain; 12 had returned to work with 6 declaring little/no restrictions in their ability to work; 8 had returned to same level of recreational activity as prior to injury with 7 declaring little/no restrictions in their ability to participate in recreational activities.

At final follow-up evaluation of 11 patients treated *surgically*, 4 had little/no pain; 7 had returned to work with 3 declaring little/no restrictions in their ability to work; 3 had returned to same level of recreational activity as prior to injury with 4 declaring little/no restrictions in their ability to participate in recreational activities.

No correlation found between vertebral collapse, kyphosis, retropulsion and clinical outcome.

Conclusion: Non-operative management of burst fractures of L1 is a very safe and effective method of treatment. It reduces hospitalisation time and avoids costs and risks of surgery. Patients return to functional activities of daily living quickly and have better clinical outcome when compared with operative management.

Ankle arthrodesis—pain relief surgery for the traumatic osteoarthritis of the ankle. A long term follow-up; clinical, radiological and patient satisfaction

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Introduction: Ankle arthrodesis can provide a stable, pain free joint without serious complications and many have accepted ankle arthrodesis as yielding good long-term clinical results. The aim of this study was to look at the long-term follow-up of patients

who have undergone ankle arthrodesis; we assessed the patients clinically, radiologically and their satisfaction with results after the joint fusion.

Method: The results of 15 ankle arthrodesis, mostly performed for post traumatic osteoarthritis have been reviewed. Of these 12 were assessed by ASFA, SF36 and radiographically after an average follow up period of 30 months.

Results: Anterior approach and anterior sliding graft gave the most satisfactory results with 100% union. Very few patients required modification of their footwear, most patients are able to walk independently with a slight limp and able to return to their pre-operative work. However, after operation the ability to run and participating in acute sports was limited. Complications included wound infection and some changes in mid tarsal mobility, but good pain relief was achieved in majority of patients.

Discussion and conclusion: In conclusion, in our study it shows ankle arthrodesis is a good pain relieving operation (overall patient satisfaction was 83.33%) for post-traumatic OA. Anterior approach with sliding bone graft showed good results (100% union).

New nailing technique for proximal tibial fractures

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Background: Treatment of high-energy proximal 4th tibial fractures is highly challenging and still evolving. Both operative and non-operative methods have significant morbidity. Operative methods described are external fixation, internal fixation with plate and screws, hybrid fixation and Intramedullary nailing. Majority of these fracture are associated with severe soft tissue injury over the fracture, vascular injury with or without compartment syndrome and ligaments injuries of knee joint. We have found that a new nailing technique using Intramedullary Supracondylar nail (Smith and nephew) with intra-articular entry point for the proximal fourth tibial fractures has excellent short-term results.

Methods: Between December 1999 and February 2004 15 patients with 15 proximal tibial fractures were treated with this nailing technique. All 15 patients were followed for 24—42 months. All patients had clinical and radiological examination. They were assessed by Hospital for Special Service Knee scoring.

Results: Twelve patients were rated excellent and three patients as good. Additional procedures like bone grafting (3), plastic cover (5), dynamization of nail (2) and removal of metal were (1) were performed. There is no reference in the world literature about this technique.

Conclusion: IMSC nailing of distal femoral fracture is a standard surgical procedure. The same nail is used for proximal tibial fractures not suitable for conventional nailing. The advantages are knee joint is free to mobilize, no further soft tissue insult because of surgical incision over the fracture site as in plating and patient can be turned prone for exposure of popliteal fossa in case of PCL avulsion or vascular repair.

Pre-incident psychiatric morbidity amongst personal injury claimants

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The rate of litigation following personal injury is rising at an exponential rate with no concomitant rise in the actual incidence of these injuries. It is recognised that physical injury can lead to mental health disturbance and such mental health disturbance can delay recovery following injury. No previous study has assessed the incidence of pre-existing mental health morbidity amongst personal injury claimants.

The general practitioners records of 750 consecutive personal injury claimants were examined. Mental health diagnoses prior to the index injury was noted and classified using the Diagnostic and Statistical Manual of the American Association of psychiatry. Any treatment by mental health professionals was noted.

There was a highly statistically significant excess of pre-injury psychiatric morbidity was identified in the study population. There was a 40% incidence of at least one mental health diagnosis. There was a highly statistically significant excess of depression and anxiety. Ten percent of the study group had received treatment from at least one mental health professional.

Pre-existing psychiatric morbidity appears to be an independent predictive factor for pursuing litigation following personal injury. In light of existing knowledge that such psychiatric morbidity often results in prolongation of physical symptoms and poor response to standard treatment regimes, it is important to recognise such patients when providing a prognosis in a medico-legal context.

Diastasis screw in distal tibiofibular joint

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Background: The management of syndesmotic injuries is controversial. Positioning of ankle to 90° and placement of screw at the level of/or above the syndesmosis, number of cortices and weight bearing before the removal of screw are subjects for discussion. Many authors have warned of complications with screw fixation related to operative technique, mechanical failure of the screw, and abnormal kinetics of the joint but there is no consensus about the technique.

Material and methods: The aim of this study was to survey the current practice. A standard questioner containing eight questions about the technique of fixation was sent by post and e-mail to the consultants and trainees of south-west region of England and the same questioner was given to the delegates of fifth EFAS instructional course in Bristol 2003. Forty-five responses from trainees, 120 responses from 187 consultants and 65 responses from EFAS delegates were presented.

Results: Most surgeons agree on number of screws (single screw by 96.2% of EFAS delegates, 89.7% of SW surgeons), and placing the screw above syndesmosis (71.2% of EFAS delegates and 66.3% of SW surgeons). The controversy of ankle position during the insertion is evident when 42.3% of EFAS delegates and 32.6% of SW surgeons keep the ankle in maximum dorsiflexion but the rest does not agree with this.

Conclusions: This survey gives a good insight in to the present controversies of diastasis screw insertion. Dorsiflexion of ankle is traditionally advised to prevent over tightening of syndesmosis. Recent evidence does not support this argument and present study confirms the controversy which needs an attention.

Physical examination of the carpal bones by orthopaedic and accident and emergency surgeons: a prospective survey

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In recent years in the UK there has been a trend away from formal teaching in anatomy at both the undergraduate and postgraduate level. The aim of this study was to review the effectiveness of physical examination of carpal bones by current orthopaedic and accident and emergency surgeons.

Method: A prospective survey of 58 clinicians was conducted. Each clinician was asked to palpate seven commonly injured surface markings of the same uninjured wrist, whilst scrutinised by a constant observer. Eight clinicians declined to participate.

Results: Four percent of participants correctly palpated all bony landmarks. Ten percent failed to accurately palpate a single bony landmark. The scaphoid waist and trapezial ridge were accurately palpated by 72% and 22%, respectively, thus demonstrating the wide disparity in the knowledge of surface anatomy.

Conclusion: The majority of orthopaedic surgeons and A&E clinicians do not perform an accurate physical examination of the carpal bones. This may be a legacy of a recent trend away from formal teaching in anatomy at both the undergraduate and postgraduate level. The ancient art of history taking, precise physical examination and elucidation of a confident diagnosis is at risk of being replaced with tentative diagnoses and imaging techniques that are expensive and time consuming.

Anterior cruciate ligament reconstruction with and without tourniquet

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The use of pneumatic tourniquet for control of bleeding in limb surgery is an age-old concept. ACL reconstruction has been done with and without tourniquet. ACL reconstruction is being done more frequently nowadays. It is still in debate if one should use a tourniquet or not. Several Studies have looked at effects of tourniquet use in ACL reconstruction. We did a prospective study of 47 patients undergoing ACL reconstruction. All patients had the same surgical procedure done; though some had this done under tourniquet ischemia and some without it. We found that the patient group in which tourniquet was not inflated had significantly better pain control. Mann—Whitney *U*-Test was used and exact significance was found to be .001 for pain control, which was statistically significant. The same test also revealed faster rehabilitation for those in which a tourniquet was not inflated. However, at one year follow up there was no significant difference in two patients groups as far as ultimate outcome was concerned as assessed by Lysholm Gillquist scoring system.

We conclude that tourniquet use is associated with more post-op pain. Muscle and functional recovery is faster without tourniquet use but in the long run both groups may have a similar outcome. This fact mattered to sportsmen who wanted faster recovery.

Clinical and radiological results of retrograde femoral nailing in elderly patients with supracondylar femoral fractures

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Background: Supracondylar fractures of the femur constitute about 7% of all femoral fractures. In elderly patients they are invariably low energy fractures predisposed to by Osteoporosis. Treatment of these fractures is a clinical dilemma with a wide range of surgical options with variable results.

Material and methods: This retrograde study looked at 23 elderly patients (>64 years) who had sustained a supra-condylar fracture of their femur and were treated by retrograde femoral nailing.

The age range of the patients was between 65 and 97 years.

Fractures were classified according to AO/OTA.

All the patients were assessed with regards to operative time, blood loss, hospital stay and wound complications.

All the patients were also assessed clinically and radiologically every 6 weeks for up to 12—18 months.

Results: Two patients died a few weeks after their operation and another three died over the next 12—36 months. The average operating time was 70 min and average blood loss 400 ml. One patient developed a superficial wound infection.

Radiologically all cases united. Thirty-nine percent had angular malunion and 30% had shortening of up to 1.5 cm.

Conclusion: Retrograde femoral nailing is surgically limited but a reliable procedure for fixation of supra condylar fractures with no intra-articular extension in elderly patients.

Although it has a high incidence of angular malunion the overall functional demands of this age group are not significantly affected.

Reproducibility of partial weight bearing

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Aims: To find out whether partial weight bearing can be reproduced and retained.

Methods: In vivo experiment in normal subjects. Twelve subjects were asked to reproduce 25% of their body weight through either the dominant or non dominant limb on force platform (Kistler, Switzerland) after three practice attempts on bathroom scales with concurrent visual feedback. No feedback was provided after the measurements on force plate. The process was repeated after 1 h without any practice sessions in the interim period to find out if the weight practised could be retained.

Results: The mean '0' minute reading was found to be 25.9% of body weight while the mean '60' minute reading was found to be 24.4%. The '*p*' value for the difference between the two means was found to be 0.3841. When the data was classified into dominant and non-dominant groups, it was found that the standard deviation of the dominant side was less than that of the non-dominant side. Moreover the means of the '0' minute and '60' minute readings were more consistent on the dominant side.

Conclusions: This study indicates that partial weight bearing instructions can be quantified and graded. Simple bathroom scales are sufficient to educate the patients and this can be practised at home after an initial period of supervision. The demand of the present time is a scientific method of partial weight bearing which is easily reproducible in practical life and our study provides a good and reasonable option.

Long term results of intramedullary supracondylar nailing for distal femoral fractures

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Aims: The aim of the work is to report about 4.5-years experience with percutaneous retrograde femur nailing for fractures of distal femur in 25 patients.

Material and methods: During January 1999 to June 2003 we used the percutaneous method of retrograde femur nailing in 25 cases. Twenty-eight percent fractures were open and 72% were closed. Twelve percent of the fractures had intraarticular extension. AO classification was used to classify the fractures. Eighty-four percent of the fractures were due to high velocity trauma. Average follow up was

20.1 months (range 6—40 months). Average age of the patients was 31.5 years. All patients were started on knee mobilization exercises immediate postoperative period. However, full weight bearing was not allowed until clinical or radiological signs of union.

Results: No postoperative complication related to fracture treatment was seen. Average time of union was 3.1 months (range 2—4 months). Average knee range of motion was 117°. Even in open injuries, 85.7% had more than 110° range of motion. All patients could return to their pre-injury lifestyle. Rating scale developed by Hospital for Special Surgery was used to quantify the results. Eighty-four percent showed excellent, 4% showed good, 8% showed fair and 4% showed poor results. Percutaneous supracondylar nailing is thus, an excellent method of treating fractures of distal femur.

Conclusion: Percutaneous retrograde femur nailing is thus an excellent method of fixing fractures of distal femur in young patients. Even in open fractures, it gives good results.

An epidemiological analysis of blunt ocular trauma in a city hospital—the tip of the iceberg

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One of the major differences in epidemiological factors between a quiet suburb and an inner city hospital is trauma. I observed the greater prevalence of trauma victims with varying ocular injuries. These high-risk patients demand meticulous examination at presentation and clinic visits. The aims of my study were to evaluate the incidence, assess the visual recovery and improve available resources. I performed a prospective study of 100 patients over a six month period utilising the American Public Health Association Model, i.e. The Host-Agent-Environ Model. This included demographics, injury classification, intracranial complications and surgical intervention. My analysis revealed the trauma patients were 4% of the eye casualty population; the mean was 14.2 patients per month with a peak incidence during the 'season of giving', December. The following facts were noted:

- 70% were over 21 years, male preponderance (67%), left eye (57%);
- accidental (60%) versus nonaccidental (40%);
- the adult population—(66%) were non-accidental;
- anterior segment injury (100%); posterior segment (15%); intracranial (9.5%);
- surgical intervention (4.11%);
- visual function was noted as loss of Snellen lines: 0 (50%); 1 (23%); 2 (10%); 3 (6%); >4 (10%). Recovery to baseline was seen in 95% of patients.

Of specific interest we allocated 1 h/patient for human resources. This included eye casualty and clinic assessment and appropriate investigations. The basic workup resulted in an allocation of 20.5 days for the year, i.e. one month per year for these patients.

My conclusions and recommendations were to involve a year long prospective study with detailed determination of risk factors. There would have to be more careful collection of data as sometimes this was severely lacking. We have since introduced a protocol to maximise data collection and patient assessment stressing on meticulous posterior segment and appropriate neurological examination.

The use of multimedia messaging in the referral of musculoskeletal limb injuries to a tertiary trauma unit using: a one month evaluation

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Objectives: New developments in telecommunications will have a profound effect on the delivery of medical care throughout the world. In Northern Ireland three trauma centres provide fracture care for their own and surrounding Emergency departments. All trauma referrals are currently taken by telephone. It is our experience that the verbal description of the radiographs of a musculoskeletal limb injury can be inaccurate, necessitating us to view the plain films of the patient. By utilising a recent advance in telecommunications technology, the launch of mobile handsets with multimedia messaging service capability, it is now possible to digitally capture and instantly send an image of a plain film.

Purpose: To evaluate the use of multimedia messaging as a supplement to the telephone referral of musculoskeletal limb injures.

Method: Following a referral using, the Emergency physician and the Trauma surgeon evaluated the multimedia consult through a survey questionnaire.

Results: Between the 1st December 2003 and the 1st January 2004, 46 multimedia consultations were performed. Picture quality was acceptable in all but one of the referrals. In 35 of the 46 referrals the multimedia image of the plain films was felt to improve the management of the patient. In 8 of the 46

referrals the multimedia image of the plain films was felt to change the management of the patient.

Conclusion: A multimedia messaging store- and forward telemedicine system has potential to facilitate the rapid, cost-effective management of musculoskeletal limb injuries thereby enhancing clinical care.

Traumatic knee dislocation. Outcome in ACL deficient knees

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Background: Traumatic knee dislocation is a rare but devastating injury as it results in multiligament instability. Treatment remains controversial. A new approach to bicruciate rupture with posterolateral corner insufficiency is described.

Aim: We present a case series of six patients who sustained bicruciate rupture and posterolateral corner injury.

Methods and materials: Six patients (all male, mean age 29 years) with traumatic knee dislocation and resultant bicruciate and posterolateral corner injury were treated with arthroscopic PCL reconstruction (hamstring graft) and repair of the posterolateral corner (using autogenous or cadaveric tissue). In each case the ruptured ACL was not reconstructed leaving an ACL deficient knee. Scores used were Tegner, Marshall and Lysholm.

Results: Time to surgery was on average 7 days (range 3—11 days). After a mean follow up of 29 months (range 12—49) the mean flexion was 123.5° and mean extension 3°. The mean Lysholm score was 80 and the mean Marshall score was 36. On average patients lost one grade of activity as determined by the Tegner score. In all cases the Lachman test was positive but this did not translate to subjective instability.

Conclusion: Good results are possible following this type of surgery for traumatic knee dislocation. The ACL deficiency did not translate to clinical instability and there are no current plans to reconstruct the ACL in any patient.

The effect of general anaesthesia on mental function in patients with hip fracture

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Objective: To determine the effect of general anaesthesia compared to regional anaesthesia, on mental function in patients who have sustained proximal femoral fracture. Further, to determine the effect of deterioration in mental function on overall outcome for the patient.

Design: A prospective observational study.

Setting: A regional trauma centre where patients received a high quality of clinical care.

Patients: One hundred and seventy consecutive patients over the age of 60 years were included. The mean age was 82.6 years.

Intervention: Patients received either general or regional anaesthesia for their surgery. This decision was made by the anaesthetist. Pre and postoperative mental function was determined using the mental test score (MTS) recorded by the same clinician.

Main outcome measurements: MTS scores were recorded pre and post-operatively. Other variables recorded were length of stay in hospital, when fit for discharge, place of discharge, mortality and morbidity. Multivariant analysis was performed by a professional statistician using statistical package for social scientists X (SPSS) software.

Results: The MTS decreased by 2.43 points when general anaesthesia was administered compared to 1.5 for regional anaesthesia ($p < 0.01$, Mann—Whitney). Lower postoperative MTS values were associated with increased mortality ($p < 0.001$, Mann—Whitney). The greater the decrease in MTS (between pre- and postoperative values) the more likely it is that the patient will be institutionalised ($p < 0.01$, Mann—Whitney).

Conclusion: General anaesthesia does cause significant deterioration in mental function compared to regional anaesthesia. Lower mental test scores are associated with increased mortality and institutionalisation.

Primary repair of mammalian bite wounds—a review

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Introduction: The treatment principles of mammalian bite wounds have undergone changes over the past years. In our centre we have been practising early repair for these injuries and this study was undertaken to review this practice over the past two years. A second aim of the study was to analyse the A&E practices in the initial management of these patients as well as to make recommendation for future treatment protocols.

Results: There were a total of 122 patients with 150 bites. Dog bites formed the majority of cases

followed by human bites. There were interesting differences in the demography and treatment seeking patterns between human bites and dog bites. Ninety-two percent of the patients underwent operative repair with a median delay of 6 h. The operative procedures ranged from repair of lacerations to tendon repairs and flap reconstructions. Wound infection rate was 12%, including five patients who presented late with infected wounds. Analysis of A&E practices revealed lack of protocols and heterogeneity in treatment patterns.

Conclusions: This study has revealed that early repair of mammalian bite wounds is a safe practice. It has also underscored the need for protocols for A&E management of these patients.

Check radiographs after dynamic hip screw fixations—do we need them routinely?

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The purpose of this study was to find out whether routine post operative check radiographs after DHS (Dynamic Hip Screw) fixations are contributing to patient management. In a random selection of 50 NHS hospitals in England, 18 orthopaedic units were found to be ordering formal check radiographs after DHS. In our department check radiographs were routinely being done even though image pictures were printed in theatre. We reviewed 174 DHS fixations, assessed adequacy of image intensifier pictures and compared them with post operative radiographs. 115 stable fractures showed no change in position of fracture or screw. In 59 unstable fractures 14 showed medialisation of femoral shaft. 132 case notes were reviewed and none of these patients have had a change in post operative mobilization status based on check radiographs. The 14 unstable fractures which showed change in position too continued with mobilization.

We conclude that routine check radiographs are unnecessary after DHS fixations if adequate image pictures are obtained at surgery. It has important implications like manpower and cost, patient discomfort and unnecessary radiation.

An in vitro analysis of the pressure distribution at the wire—bone interface in ring fixators

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The aim of this study was to characterise the pressure distribution in cancellous bone around tensioned, loaded fine-wire fixators.

A model was developed using a single, tensioned fine wire passed through a cancellous bone block. The wire was tensioned on a circular fixator ring. Contact pressure film was applied to the suspended block and a second block placed on top of the film. A standard force was then applied to the upper block. The distance from the pressure film to the wire was increased incrementally.

The results show three phases of pressure distribution. Very close to the wire there is a polar distribution of pressure. At a depth of 1.5 mm away from the wire the pressure becomes evenly distributed along the path of the wire in a beam-loading manner. At a distance of greater than 4 mm from the wire there is even distribution of pressure throughout the bone.

Most of the pressure measured was less than 1 MPa, which is less than the yield strength of cancellous bone (2—7 MPa, Li and Aspden, 1997). This allows us to explain why fine wire fixators do not cut out when used in cancellous regions such as the upper tibial metaphysis. In contrast a similar analysis using threaded half pins under the same conditions showed far higher pressures (20 MPa), which were present deeper in the bone specimen. The pressure was concentrated toward the pin entry site and was not well distributed throughout the pin-bone interface. This is the first reported analysis of pressure distribution at the wire—bone interface and demonstrates why ring fixators have a lower loosening rate than half pin fixators when used in metaphyseal bone.

A biomechanical analysis of the LCP vs. LC-DCP in an osteoporotic bone model

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Introduction: The UK has more than 19 million people aged over 50, including 9.4 million aged over 65. This has major implications for Orthopaedic surgeons given that fracture fixation is technically demanding in osteoporotic bone.

The recent development of the locking compression plate (LCP) by the AO group is an attempt to solve the afore mentioned problem. The objective of my study is to compare the stability and mode of failure of the LCP versus the low contact dynamic compression plate (LC-DCP) in an osteoporotic bone model.

Method: Osteoporotic synthetic dowels (synbone) were used as a bone model. Six dowels were

instrumented with an eight hole narrow large fragment LC-DCP with four 4.5 mm cortical screws. Six dowels were instrumented with an eight hole LCP using four 5 mm locking screws. A 1 cm osteotomy was created in the bone at the centre of the plate so there were two screws above and below the osteotomy.

Each specimen initially underwent non-destructive static mechanical testing in compression, four point bend (0 and 90°) and torsion using an Instron 3850. The specimens were then cycled in axial compression 350 NM at 5 Hz for 30,000 cycles. The static non-destructive tests were repeated in the four loading modalities. The specimens were finally loaded to failure. The observed mode of failure was noted.

Results: There was no statistical difference in the stiffness of the LCP post cycling in all four loading modalities. There was no statistical difference in the osteotomy gap post cycling. All specimens in the DCP failed static testing. No fatigue testing could be undertaken in this group.

Discussion: The LCP is biomechanically superior to the LC-DCP in an inferior quality bone model. The cause of failure of the LC-DCP is discussed. We suggest that the LCP should be used in Osteoporotic fractures where difficulty in achieving a stable fixation is anticipated.

Metacarpal shaft fractures—a retrospective review of three treatment methods

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Introduction: Diaphyseal fractures of the metacarpals are common injuries that can lead to impairment of hand function. There are three major mechanisms of fixation, intramedullary wires, transverse wires, and plate fixation. The aim of the study was to determine the best method of fixation in our unit.

Method: All patients who underwent one of the three methods of fixation between 2000 and 2002 were included in the study. A retrospective review of the case notes and X-rays was undertaken. Demographics and complications were recorded. The pre and post operative X-rays were assessed to measure the accuracy of reduction. Clinical review of the patients was undertaken and the range of movement and grip strength recorded.

Results: Thirty-four patients with 43 metacarpal fractures were identified. A summary of the results are shown in the table below.

Group	Age	M:F	R:Lt	No. of MC	Pre volar angle	Post-volar angle	Range of movement	Grip strength
1	29.4	6:1	7:0	9	44.44	17.22	97	87%
2	29.4	17:0	16:1	22	45.14	19.56	98	89%
3	27.9	9:1	6:4	12	32.83	5.5	100	87%

Conclusion: This is predominantly an injury of young males. Plating achieves the best anatomical correction. There is no statistical difference in overall function between the three groups.

Post operative radiographs following hip fracture surgery: a National Audit. Do they influence in patient management?

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There is still much debate on the appropriateness of taking post operative radiographs especially in the presence of high quality radiography that image intensifiers now provide. The aim of this study was to determine whether there was a nationwide consensus on check radiographs and to compare this practice with the implant related complications. A postal performa was sent to 400 randomly chosen UK Trauma and Orthopaedic Consultants to assess their practice regarding taking check radiographs following hip fracture surgery.

In addition a case note review of all patients undergoing hip fracture surgery over the three years of 2001—2003 at Selly Oak Hospital, was performed to identify patients undergoing revision surgery in the same admission and whether a routine check radiograph had influenced their management.

Response rate to the performa was 66.7% (300/450). 96% routinely took postoperative radiographs following hemiarthroplasty. However, only 17% of these took them as criteria to mobilise the patient. In the DHS group, 61% took check radiographs and 25% of these took them as criteria to mobilise.

Following cannulated screw fixation, 58% routinely performed check radiographs and 33% used it as criteria to mobilise. Of the 1265 operations performed in three years only one surgical procedure was required for a problem identified on routine check radiograph.

We highlight the lack of national consensus on the use of post operative radiographs. We suggest that the use of post operative radiographs should only be undertaken when clinically indicated, hence sparing the patient from discomfort, unnecessary exposure to radiation as well as allowing more effective utilisation of radiological and human resources.

The relationship between the Injury Severity Score and Revised Trauma Score with the probability of survival for our trauma patients and how this compares with the predicted relationship

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Aim of study (*background*): Application of simple assessments and measurements has allowed trauma to be quantified and compared. Some Scores are used retrospectively to evaluate a treatment modality or compare the treatment results of two treatments or trauma centres e.g. AIS, ISS, RTS and TRISS. Probability of survival is affected by the ISS, RTS and age and is calculated by these parameters. The aim of my study was to assess the relationship between ISS and RTS with the probability of survival for our trauma patients and test how this compared to the predicted relationship.

Material and methods: A retrospective study was carried out from January 2001 to August 2003. The ISS and RTS scores for 120 trauma patients attending the A&E during this period were calculated from the trauma charts. The relationship between ISS and *p*s was assessed using the correlation and regression analysis and then RTS was added to the regression analysis to see how this affected *p*s.

Results: Injury severity scores of trauma victims had a mean of 21.69 (range, 2−50). The results showed a strong negative correlation between ISS and *p*s with an *r*-value of -0.692 ($p < 0.005$). Both the variables RTS and age also showed a strong correlation with *p*s, with an *r*-value for RTS of 0.552 and for age of -0.529 ($p < 0.005$). Using regression analysis, RTS made a stronger contribution to *p*s ($r = 0.594$) but the correlation between ISS and age with *p*s was strong and statistically significant ($p < 0.005$).

Conclusion: The results indicated strong correlations between ISS and *p*s and this is helpful for the patients in whom TRISS scores cannot be calculated and results also confirmed the multivariable correlation between RTS, age and ISS with *p*s for our patients. This was in keeping with the predicted relationship.

How should radial neck fractures be fixed? A biomechanical analysis

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Objective: The aim of this study was to evaluate the biomechanical stability of four methods of internal fixation for fractures of the radial neck in adults.

Methods: The four methods of fixation studied include the small T plate (L50mm), locking T plate (L50mm), modified one third tubular plate (distal hole of a four-hole plate cut through its centre creating two sharp prongs which are pushed into the radial head) and flexible elastic intramedullary nail. Using synthetic Sawbones, a standardised transverse osteotomy of the radial neck was carried out after completion of the fixation device to simulate a fracture. Biomechanical analysis was carried out to compare their stiffness in cantilever bending, torsion and axial compression.

Results: For bending stiffness, the locking T plate offered the greatest stability. This was followed in descending order by the T plate, modified one-third tubular plate and flexible nail. This was statistically significant with a *p* value of less than 0.05 and a Bonferroni coefficient of 0. This was true in both the anteroposterior and mediolateral planes.

For torsional stability, the flexible nail was also found to be significantly less stiff than the other three fixation constructs. This was statistically significant for all three comparsions.

For compression stiffness, the locking T plate was found to be the most rigid, although the comparison with the other three fixation constructs did not reach statistical significance.

Conclusion: The locking plate was found to have the greatest biomechanical stability. Its main disadvantages relate to the need for direct exposure of the fracture site and potential of hardware impingement. Although least stable, the flexible nail offers an alternative method of flexible fixation with preservation of soft tissue vascularity.

The mortality of hip fracture surgery in a District General Hospital over a 4-year period. Identification of an at risk group of patients who sustained in hospital fractures

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Aim: To evaluate the mortality of patients undergoing surgery for hip fractures at Eastbourne General Hospital. This included mortality of patients who sustained their hip fracture while already an inpatient, effect of delay in surgery, effect of age, sex and type of implant, effect of anaesthetic and their effect on the time spent rehabilitating in hospital.

Method: A retrospective study using hospital notes of patients who sustained a hip fracture between January 1999 and February 2003. The hospital notes were used in combination with death certification to provide mortality data. We calculated the 30 days, 90 days and 1 year mortality for all the patients.

Results: A total of 1254 operations were performed during this period (814 hemiarthroplastys and 440 dynamic hip screws). The mortality of all the patients at 30 days was 7%, at 90 days was 16% and at 1 year was 27%. The study identified a subgroup of patients that were already an inpatient when they sustained their fracture of the hip and the mortality of this group of patients was 15.1% at 30 days, 26.2% at 90 days and 41% at 1 year which was a statistically significant difference at $p = 0.001$, $p < 0.001$ and $p < 0.001$. There was no significant difference between the mortality in patients with a hemiarthroplasty versus dynamic hip screw fixation, however the mortality was higher in males who had undergone hemiarthroplasty (36.8%). The mortality in all groups increased with age. The mortality was also identified to be higher in those patients waiting longer than 48 h prior to surgery and this was significant at $p = 0.01$, $p < 0.001$ and $p < 0.001$ for 30 day, 90 day and 1 year mortality, respectively.

Conclusion: Increasing mortality figures are seen in male patients, older patients, those that wait longer for surgery and those that sustain their fracture while already an inpatient. There was no effect on anaesthetic or type of fracture.

	Mortality (%)		
	30 day	90 day	1 year
Total	7.5	16.5	27.4
Inpatient fractures	16.4	26.2	41
Hemiarthroplasty	7.2	16.7	27
DHS	8.1	16.1	27.7
Male (hemi/DHS)	10.5 (12.8/9.7)	22.7 (24.5/19.5)	36.1 (36.8/34.8)
Female (hemi/DHS)	6.6 (6.4/7.4)	14.7 (14.6/15.2)	25 (24.6/25.)
Waiting time to surgery <2 days	6.7	16.1	15.7
Waiting time to surgery >2 days	9.9	22.2	30.4
Age			
<70	2.7	8.2	17.8
70–80	4.5	9.4	16.4
80–90	5.9	14.1	25.2
>90	15.1	30.2	44.6

Do as I say, not as I do: a 5-year review of abdominal stab and gunshot injuries

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Background: Selective conservative management of penetrating abdominal injuries is well recognised, however experience and training in the management of penetrating abdominal injuries is limited in the UK. We had no formal protocol for this. The aim was to review our current practice.

Methods: We reviewed notes of all patients admitted with penetrating abdominal trauma between 1st January 1999 and 31st December 2003, with regard to patient demographics, mechanism of injury, investigations performed and outcome of treatment.

Results: Sixty-seven patients (62 stab and 5 gunshot wounds) were identified, with a mean age of 28 years. Annual incidence was increasing, with the majority presenting outside normal working hours. Twenty-eight patients underwent surgery. Following resuscitation the decision for operative management or observation was based on clinical criteria alone in 22 patients, additional imaging in 14, local wound exploration in 26 and combined imaging and exploration in 5. Haemodynamic instability and generalised peritonitis were universally associated with positive operative findings. Half (6/12) the operations performed for peritoneal violation (defined on wound exploration or by omental evisceration) in the absence of other indications, were non-therapeutic. One significant missed injury occurred after a gunshot wound in a patient with a false-negative CT scan.

Conclusions: Gunshot wounds in this series were associated with significant intra-abdominal injury requiring surgical intervention. Abdominal stab wounds can be successfully managed by observation and reassessment in the absence of peritonitis or haemodynamic instability. Local wound exploration added little to the evaluation of these patients. Laparotomy for peritoneal violation alone led to an unacceptable rate of non-therapeutic procedures, and should be abandoned as an indication. Consideration should be given to an initial trial of observation or additional diagnostic studies in patients with omental evisceration but no other indication for surgery. Local protocols may assist the provision of care for patients with these injuries.

Comminuted olecranon fractures—how not to shorten or lengthen when applying internal fixation

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Purpose: To calculate a clinically relevant and intra-operatively accessible measure of olecranon length that could be reliably applied by the operating surgeon to optimise comminuted olecranon fracture fixation.

Materials: One hundred normal adult antero-posterior and lateral radiographs of the elbow were studied with respect to the proximal olecranon width (OW), greater sigmoid notch width (SW) on lateral views, trans-epicondylar distance (TED) and trochlear width distance (TWD) on AP views. The mean ratios of TWD/SW and TED/SW and an index OW*SW/TED along with their standard deviation (S.D.) and normal ranges were calculated.

Results: The average olecranon width was 24.7 mm (range 21—29 mm), sigmoid width was 26.2 mm (range 21—32 mm), trans-epicondylar distance was 58.65 mm (range 49—74 mm) and the trochlear width distance was 26.98 mm (range 22—32 mm). The average ratio of TWD:SW was 1.03 with a S.D. of 0.07 and that of TED:SW was 2.25 with a S.D. of 0.16. The average index worked out to be 11.02.

Conclusions: Comminuted fractures of olecranon are a surgical challenge since it is often impossible to gauge the correct length of the olecranon process. There have been no objective data described to prevent shortening or lengthening of the greater sigmoid notch after reconstruction. Our data can be easily applied to the clinical situation, by taking intra-operative radiographs, and calculating the index as demonstrated above. Within 1S.D. of this value may be considered adequate for this challenging pathology. This index will guide the surgeon to obtain a more reliable length of the olecranon, and devolve surgical guesswork from the final outcome.

Punishment gunshot wounds in Northern Ireland

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The gunshot injuries in Northern Ireland are different in their pattern and outcome. We wanted to ascertain the differences in outcome of these injuries in comparison to the published literature.

One hundred and fifty gunshot injuries in 59 patients during 2001—2002 were studied retrospectively. A review of casenotes and radiographs was performed looking at nature of injuries, treatment and outcome. Time to healing of bony and soft tissue injuries as well as the incidence of complications were determined.

About 50% of the punishment gunshot victims were male teenagers. Majority were unemployed or unwilling to disclose their occupation. Ninety-five percent of these patients had bony involvement and 5% had only soft tissue involvement. Although, 11% had neurological involvement, none had vascular or visceral injuries. Of the 113 bones involved, majority involved distal Tibia and Talus. Most soft tissue injuries healed in 3—6 weeks and bony injuries in 8—12 weeks depending on the bone involved. There were no deaths due these injuries. Complication rate for injuries treated in A&E was not significantly

different from those treated in the operation theatre. Neuro-vascular involvement and complication rates for these injuries were lower than those in the published literature.

Punishment gunshot injuries with stable configuration can be treated in A&E (ER) with comparable results.

The treatment of intertrochanteric fractures by a new intramedullary inplant: the Holland Nail

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Aim: The aim of this study was to investigate the outcome of intertrochanteric fractures treated by a new intramedullary nail between June 2001 and August 2002.

Method: A prospective study of 57 patients with intertrochanteric fractures treated at St. Peter's Hospital Chertsey. The following data was recorded on initial presentation: age, sex, type of fracture, mental test score, ASA score, mobility, residential status and co-morbidity. Intra-operatively the following data was recorded: grade of surgeon, grade of anaesthetist, type of anaesthetic, type of implant used and blood loss. Post-operatively and on follow-up the following data was recorded: length of time to weight bearing, time to discharge, morbidity and mortality, post-operative complications, follow-up mobility, residential status and pain on weight bearing.

Results: A total of 57 patients were included with inter-trochanteric fractures. The average age was 80.7 (41—96). The fractures were classified as stable (25%), unstable (60%) or transverse (12%) as per the Evans classification. Patients took an average of 3 days (1—9 days) days to weight bear and remained in hospital for an average of 21 days (5—110 days). Fifteen cases had difficulty with distal locking screw insertion. There was no record of needing opening reduction of the fracture in any patients and the blood loss at surgery was unrecordable. Fifty-five patients were followed up with an average of 146 days (46—493 days). The 30-day mortality was 7% and the 90-day mortality was 16%. Two patients developed superficial infection and were successfully treated with antibiotics. Two patients required removal of backed out pins and two needed revision due to cutting out of the head (3%). Delayed union was defined as patients with continuing pain after 6 months and was seen in five patients.

Conclusions: Although the Holland nail is a successful implant in the treatment of intertrochanteric fractures, further evaluation is required to compare the efficacy against other types of implant.

Non-vascularised fibular grafting in the management of neglected fracture neck femur

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Aims and objectives: Neglected musculoskeletal trauma is a common cause of morbidity in the developing world. Management of neglected fractures of the neck of femur in the young patients pose a special problem. The aim of our prospective observational study was to evaluate the use of non-vascularised fibular graft in the management of these cases.

Material and methods: A total of 17 cases of neglected (defined as untreated for more than 3 weeks) intracapsular fractures of the neck of femur were included in the study. The average age of patients was 56.7 years. Fractures were classified as per the AO classification. Patients with associated injuries to the hip and pelvis were not included in the study. Average duration of neglect was 4.3 weeks. MRI of the hip was done in all cases to see for AVN of the femoral head. Patients with AVN were not taken up for the Procedure. All patients underwent closed reduction (Leadbetter or Whitmann technique) and internal fixation with two cannulated screws supplemented with a fibula. In all cases, two screws with an intervening fibula were used. Patients were kept non-weight bearing for 8—10 weeks and serial progress noted on radiographs.

Results: We used the modified Harris Hip Score to evaluate the results at the end of 1 year. Besides union other factors, which were taken into consideration as indicators of good result were walking distance, absence of hip pain and absence of fixed deformities at the hip. There were five excellent, seven good and four poor results with one patient lost of follow-up. The average time for union was 14.2 weeks. Total fibular incorporation into the femoral neck was only seen in one patient.

Anterior plate fixation and bone grafting for symptomatic non-union of middle third of clavicle

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In symptomatic clavicular non-union, plate fixation with or without bone grafting is generally preferred over other methods of internal fixation. The superior surface is most commonly used for plate fixation. To the best of our knowledge, there are no clinical

reports where anterior plate fixation of the clavicle was used.

We report the results of anterior plate fixation for symptomatic, mid shaft clavicle non-union in 12 patients aged between 23 and 56 years. There were 11 males and 1 female with five right and seven left. The injury was secondary to RTA in six cases, sports related in six. In three of the cases, the non-union was secondary to superior plating in acute fractures. The most common symptom was anterior shoulder pain in 12 patients followed by brachialgia in 4.

The operation was performed through an anterior approach. A 3.5 mm reconstruction plate was contoured and fixed onto the anterior surface of the clavicle. Bone grafting was performed in all the cases. Postoperatively the patients were immobilised in a polysling. All 12 patients achieved union at an average union time of 7 weeks. The patients were assessed using Constant scoring. The average follow up was 22 months. Three patients had prominent metal work requiring removal of the plate.

Compared to superior plating, anterior plating has the distinct advantage that the longer screws can be used (as the clavicle is a flat bone, and the AP diameter is larger compared to supero-inferior diameter) thus improving the stability of fixation. There is less chance of injury to the subclavian vessels with anterior plating. Our results show that anterior clavicle fixation is safe and effective in achieving union, even in cases following failed superior plate fixation. We therefore recommend anterior plate fixation and bone grafting in symptomatic non-union of mid third clavicle fractures.

The 'fibula nail' for stabilisation of lateral malleolar fractures: the early results

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In treatment of unstable ankle fractures the goal of surgery is to achieve union of the lateral malleolus in anatomic position thus allowing it to act as a lateral buttress and prevent lateral talar shift. Open reduction and internal fixation with plate and screws is the most commonly used option. When absolute stability is achieved, the results are excellent. Restoration of fibular length, its position in the fibular groove and tibio-fibular alignment are important for good functional result in ankle fractures. These goals are difficult to achieve using plate and screws in osteopenic bones and in comminuted fractures. In such instances, other means of fixation such as tension band wiring have been used. Internal fixation using intramedullary devices has been reported but is not widely practiced. At our hospital 12 unstable fractures of lateral malleolus were stabilised using Stainless Steel Taper (SST) intramedullary device from February 2003 to July 2004. The average age of patients was 53 years (21—85 years). All patients were partial weight bearing by 3 weeks. All fractures united clinically and radiologically after a mean period of 12 weeks. One patient developed superficial stitch abscess. There were no other complications. A static locked intramedullary device is an attractive option as it is a load-sharing device and can also be used in osteoporotic bones and comminuted fractures, maintaining fibula length and rotational alignment. If plate and screws are being used surgery may be delayed by several days in presence of severe ankle swelling. This technique has been successfully employed in the presence of significant soft tissue swelling, which reduced the overall length of hospital stay for the patients thus reducing the costs of inpatient treatment.

Outcomes after arthroscopic surgery following first, anterior, traumatic, shoulder dislocation in young adults. A meta-analysis of 13 studies involving 433 shoulders

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Aim: The re-dislocation rates in adults (<30 years) in the initial 12 months after first anterior traumatic (FAT) shoulder dislocations treated non-operatively vary from 25 to 95%. The purpose of this study was to establish if arthroscopic surgery reduces the incidence of recurrent instability (failure) after such dislocations when compared to non-operative treatment.

Material and methods: Specific search terms were used to retrieve relevant studies from various databases extending from 1966 to May 2004. Guidelines for reporting of meta-analysis, adapted from QUOROM statement were followed.

Results: Thirteen studies involving 433 shoulders were reviewed. *Group A* included 84 shoulders treated by arthroscopic lavage without stabilisation. There were no subluxations. The re-dislocation rate was 14.3% (12/84). *Group B* had 179 shoulders treated by arthroscopic stabilisation. The incidence of subluxation was 5.02% (9/179) and dislocation was 6.14% (11/179). Failure following arthroscopic lavage (12/84—14.3%) was significantly higher than

after arthroscopic stabilisation (20/179—11.2%) [$p = 0.04$, relative risk = 2.32, 95% CI: 1.07—5.05]. *Group C* involved 170 shoulders treated non-operatively. The incidence of subluxation was 8% (12/150) and dislocation was 62% (93/150). The overall incidence of failure was 70% (119/170). Failure following arthroscopic intervention (32/263—12.2%) was significantly lower than following non-operative treatment (119/170—70%) [$p < 0.0001$, relative risk = 0.17, 95% CI: 0.12—0.24].

Conclusion: Early arthroscopic surgery appears to reduce recurrent instability during the initial 12 months after FAT shoulder dislocation in young adults (<30 years) when compared to non-operative treatment. Arthroscopic stabilisation should be considered for young, athletic patients and those involved in contact sports or defence personnel, who are at a high risk of recurrent instability after FAT shoulder dislocation. RCTs reporting on a larger number of patients with a minimum follow-up of 5 years are required before one can draw firm conclusions on the ability of arthroscopic intervention to influence the natural history of traumatic anterior shoulder dislocation.

Hardware removal after open reduction and internal fixation of calcaneus fractures

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Purpose: To evaluate the subjective and objective outcomes in patients who had undergone hardware removal after ORIF of calcaneus fractures.

Materials and methods: Between 1994 and 2002, 31 cases of hardware removal was performed in 30 patients (25 male, 5 female) with an average age at operation of 47 years (31—65 years) were reviewed. Patients' demographic details were recorded including smoking habit. Fracture patterns were graded according to the Sanders' classification with pre-operative CT scans. The clinical result was assessed using Bristol hind foot scoring system. Serial radiographs assessments were also recorded.

Results: Average follow-up was 4.5 years. Average delay from time of injury to surgery was 12.4 days (range 5—24 days). Seven (23%) fractures were Sanders' type 2A, eight (26%) fractures were type 2B, six (19%) fractures were type 2C, two (6%) fractures were type 3AB and eight (26%) fractures were type 3AC. Average time from surgery to hardware removal was 27 months (range 11—45 months). There were 16 smokers and 14 non-smokers. There were five deep infections and three superficial wound infections after ORIF of calcaneus fractures. Eighty-four percent of the patients shown objective improvement following hardware removal at the latest follow-up. Two patients had unsuccessful hardware removal due to dense scarring. No wound infections were recorded. Smoking habit had no significant bearing on the objective outcome improvement following hardware removal, frequency of hardware removal and wound morbidity. Objective improvement was more predictable (mean: 23 points) in Sanders' type 2 than Sanders' type 3 (mean: 9 points).

Conclusion: Removal of hardware is justified in symptomatic patients following ORIF calcaneus fractures. It results in an improved objective and subjective outcome and has a low complication rate. Hardware removal may be considered in cases of Sanders' type 2 calcaneus fractures which are refractory to improvement.

Ten years angular stable compression plate fixation of the femur—still up to date?

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In the treatment of pseudarthrosis, refractures and posttraumatic deformities of the femur the local soft tissue situation and bone vascularisation and dystrophy causes problems of healing and infection. In the search of solutions for these complex problems we developed the ''Druckplattenfixateur—DPF'' (Compression-Plate Fixator) about 15 years ago.

This poses the question if the ''Druckplattenfixateur'', as the archetype of an angular stable fixation system, can achieve equal results as more modern implants.

Material and methods: The DPF is a titanium implant, whose angular stability is achieved by so-called covering plates, which lock the screws in a variable angle against the plate. Fracture compression is possible.

Between 1993 and 2003, the DPF has been used at the shaft of the femur 167 times in 156 Patients. All relevant data were noted prospectively. The indications were pseudarthrosis, refractures and posttraumatic deformities. Initial operations were mainly LCDC-plating and nailing/exchange nailing.

Results: Results are presented overall and by indications. We were able to follow up 86% of patients, on average 26 months postoperatively. In six cases, the implant failed. In all cases, a

low-grade infection was later found to be the cause. After revision, again with a DPF, all of these united.

We found no significant leg-length discrepancies. In one patient, a rotational deformity was not fully corrected. We found a limited range of movement especially in patients that before had long-term external fixation involving the knee.

Conclusion: The DPF is an implant that because of its design guarantees a high grade of bony unions in the shaft of femur. The waveform spares out the critical area and safes thereby periostal vascularisation. The combination of AO-technique and angular stability still makes it in our opinion a first choice implant for problem fractures and reconstructions on the femur.

New patterns of injury in lateral compression pelvic fractures

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Introduction and aims: Tile B2 lateral compression fractures are regarded as relatively benign pelvic fractures. However, recently they have been shown to have a higher resucitative requirement than previously expected and to perhaps benefit more from operative intervention. We have identified new patterns of injury within this group and noted likely indicators of increased instability.

Methods: Fifty-three patients were identified with unilateral B2 fractures. These were all high-energy injuries in a young population. Their CT scans were analysed by construction of a mid sacral sagittal plane. Reproducible reference points on the hemipelvis were identified to reflect displacements of the true and false pelvis (anterior superior iliac spine, most lateral limit of the sacral ala and ischial spine). Distances from these reference points to the plane were measured on both the intact and injured sides.

Results: There were 24 males and 29 females. Forty-three were the result of motor vehicle accidents, seven the result of falls from a significant height, the remainder being the result of sporting and industrial accidents.

Movements were observed towards the midline as in a typical lateral compression injury, but also away from the midline, inferring recoil of the fracture to beyond its starting point.

In addition, we observed asymmetrical rotation of the hemipelvis about the pelvic brim. In true compression patterns, the expected symmetrical change occurred in 34%, with 41% showing predominately compression of the false pelvis, 3% compression of the true pelvis, and 22% ''clam shelling'' of the true and false pelvis about a fixed pelvic brim.

Similarly, in the compression with recoil group, 45% showed uniform recoil, 35% showed superior compression with inferior recoil and 20% showed inferior compression with superior recoil.

Conclusions: Recoil after compression has not been recognised before. It is likely that these subgroups in addition to those with large displacements are the more unstable patterns and may benefit from operative fixation.

Comparison of patient characteristics and mortality in severely injured patients in two major trauma centres in the Australia and the United Kingdom

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Aims:

- To perform the first direct comparison of an Australian and a UK trauma centre using a benchmarking approach.
- To perform the first major trauma centre comparison to standardise for patient co-morbidity.
- To identify similarities/differences in the outcome of care provided by each trauma centre for injuries of differing type and severity.
- To highlight the role of regional/international trauma centre comparison in the improvement and evolution of trauma care.

Methods: This study compares two urban trauma centres that have both made substantial investments in their trauma registries. Their databases contain details abstracted from the medical records by trained personnel. The trauma registry in both hospitals was used to identify patients with ISS sc-

ores >15 that were admitted during the period January 2001 to December 2002. Twenty-three case mix factors were identified for each patient.

These data were used to construct a direct comparison between the two major trauma centres using statistical methods that standardise for the observed differences in case mix and outline adjusted mortality outcomes for both centres. Most significant in this study is the inclusion of patient co-morbidity thereby allowing for discrepancies in background population co-morbidity between the centres.

Results and conclusions: Data currently submitted to Professor Gilbert MacKenzie, Professor of Medical Statistics, Keele University, UK. Results pending. We will discuss the results of this study with particular regard to standardised mortality differences and methodology, in particular referring to the inclusion of co-morbidity and the efficacy of trauma registry data collection.

Outcome prediction of fractured neck of femur using orthopaedic POSSUM. Which variables matter?

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Background: Outcome following surgically managed fractured neck of femur in the elderly population remains poor. Attempts at predicting outcome and altering practice to improve outcome, remain largely disappointing, likely due to the number of variables involved. Outcome is affected by both patient and operative factors and predictive models are useful for audit and assessing quality of care.

Method: Prospective data from 230 consecutive patients treated surgically for a fractured neck of femur in a district general hospital during a 12-month period are presented. Observed morbidity and mortality rates are shown and compared with the Orthopaedic POSSUM score, which is a validated predictive scoring system. Outcome related to grade of surgeon and anaesthetist and time to operation is also shown.

Results: Observed and predicted morbidity rates were 43.9% and 46%, respectively, and mortality rates were 10.9% and 9.1%. Consultant Orthopaedic Surgeons performed 22% of the procedures with 16% of the complications and 19% of the deaths. A Consultant anaesthetised the patient in 54% of cases, with 59% of the complications and 56% of the deaths. Eleven percent of the procedures were performed within 24 h of hospital admission.

Further data analysis and the clinical significance will be discussed.

Discussion: The Orthopaedic POSSUM scoring system is a reliable predictor for outcome in surgically treated fractured neck of femur patients. Factors influencing outcome are complex with recommendations for clinical practice and future research suggested.

Outcome of pi plating of fractures of the distal radius

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We report the results of open reduction and internal fixation of 13 displaced distal radius fractures using the AO pi plate, a specifically designed plate for the dorsum of the distal radius (Synthes-Stratec, Welwyn, UK).

The fractures were sustained in 13 patients, 7 male, 6 female, mean age 49 years (range 21—70 years). Six were classified by the AO classification as 23C1 and seven as 23C3. Ten of these fractures were treated by a dorsal third extensor compartment based, and three by a combined dorsal/volar approach, two incorporating a twin plating technique.

Measurement of range of motion of the affected wrist at a median follow-up of 16 months revealed a median return of 74° of wrist extension, 46° of wrist flexion, 80° of pronation and 86° of supination. Median grip strength was 85% of the un-injured side. Radiographic assessment by the Scheck method was excellent in nine patients, and good in four.

The final outcome, as assessed by the Modified Gartland and Werley scale, was excellent in eight patients and good in five. None were assessed as poor. Symptoms in four patients, extensor tendon irritation in three and restricted rotation in the other, have necessitated early metalwork removal. There have been no other complications.

In conclusion, the AO distal radial pi plate produces satisfactory results for complex intra-articular fractures of the distal radius. In our experience there is, however approximately a 30% chance of requiring metalwork removal.

Internal fixation of fractures of the distal radius

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We report the results of open reduction and internal fixation of 31 displaced distal radius fractures using

one of two specifically designed plates for the distal radius, the AO pi plate and distal radial plate (Synthes-Stratec, Welwyn, UK).

Fifteen of these fractures were treated by volar plating, 14 by dorsal pi plating and 2 by a combined dorsal/volar twin plating technique. Twenty-eight of the 31 patients were clinically reviewed.

Measurement of range of motion of the affected wrist at a median follow-up of 11 months revealed a median return of 74° of wrist extension, 54° of wrist flexion, 80° of pronation and 80° of supination. Overall median grip strength was 76% of the uninjured side. However, in those patients treated by volar plating, median grip strength was 50%. Radiographic assessment by the Scheck method was excellent in 17 patients, good in 10 and fair in 2. All fractures achieved radiological union.

The clinical outcome, as assessed by the Modified Gartland and Werley scale, was excellent in 15 patients, good in 10 and fair in 3 cases. None were assessed as poor. Subjective assessment was excellent in 9, good in 12, fair in 6 and poor in 1 lady who had just suffered a flexor pollicis longus rupture.

Symptoms in four patients necessitated early metalwork removal and two further patients are currently awaiting this. Complications were seen in four patients, three of those with post-traumatic median nerve compression (all volar approaches), one superficial wound infection and one case of flexor tendon rupture.

Trauma meetings—setting the standard

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Introduction: Trauma meetings form an integral part of the orthopaedic timetable and are used for the handover of patients, management decisions, teaching and audit. The quality and format of trauma meetings has been noted to vary considerably across our region. We therefore set out to investigate the format of trauma meetings in Orthopaedic departments on a national level.

Objectives: The aim of this study was to assess the conduct and current practice of trauma meetings throughout the country. We aimed to use this information to draw up standards and recommendations to improve the quality of trauma meetings.

Method: A telephone survey was carried out of all hospitals in England over a 4-month period. The on-call duty orthopaedic surgeon at each hospital was contacted and questioned regarding the format of trauma meetings at that hospital. Details obtained included frequency and duration of trauma meetings, presence of medical staff and educational value of the meetings.

Results: A total of 120 hospitals were contacted with a 100% response rate. Eighty-six percent had formal daily trauma meetings with an average duration of 35 min (range 10—60 min). Formal teaching of juniors' occurred at 82% of meetings and review of post-operative radiographs at 69% of trauma meetings. At least one Consultant was present at 100% of meetings. Other attendees were trauma coordinators 35%, physiotherapists 31%, theatre staff 27%, ward nursing staff 20% and anaesthetists 17%.

Conclusions: The organisation of trauma meetings varies widely between orthopaedic departments. They are an important forum for education and training in the majority of hospitals. With the recent reduction in junior doctors' hours, a multidisciplinary approach to these meetings is fundamental for good clinical care of patients and for streamlining of trauma services.

Is blood transfusion a risk factor for adverse events following hip fracture?

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We analysed the characteristics and outcome for 3625 consecutive hip fracture patients, comparing mortality and infection rates for the 1068 patients who received allogeneic blood transfusions against the remainder who did not. Overall mortality for all patients at 1 year post-fracture was 27.7% (957 patients). We found that transfusion was associated with a statistically significant increase in mortality from 120 days onwards following hip fracture. However, when this was adjusted, with a statistical regression model, for baseline characteristics and confounding variables, this difference became statistically insignificant ($p = 0.17$). Infection rates in the transfusion group were 2.0% for superficial infection and 0.6% for deep infection. This compared with 1.9% and 0.9%, respectively, in the non-transfusion group. These figures were not statistically significantly different for either deep or superficial infection. In addition, we found no difference between rates of postoperative cardiovascular or respiratory complications. We thus concluded that in our series of hip fracture patients, we could find no evidence for an adverse outcome following allogeneic blood transfusion.

Smoking and hip fracture: a study of 3617 cases

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We analysed the characteristics and outcome for 467 hip fracture patients, who reported that they were currently smoking at the time of admission, against 3150 non-smoking hip fracture patients. Those patients who smoked were younger (72 years versus 81 years mean age, $p < 0.0001$), more likely to be male (35.3% versus 19.5%, $p < 0.0001$), more mobile and less likely to be living in institutional care (7.5% versus 25.0%, $p < 0.0001$). Peroperative outcomes and complication rates were similar, despite the smokers' relative youth. Mortality at 30 days was similar for the two groups (6.2% versus 7.6%), but lower for the smokers at 1 year (22.7% versus 27.6%, $p = 0.03$). However, with adjustment for the younger age and sex of these patients, this difference in mortality was not statistically significant. These findings suggest that smoking results in hip fracture occurring at a younger age. Despite this, the outcome for smokers was similar to that for the average hip fracture patient.

Infection in surgically treated civilian gunshot wounds on extremities

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Background: One of the criticisms about the studies on gunshot injuries in the past is their analysis of a heterogenous group of wounds using classifications based up on the muzzle velocity (high or low). Recommendations based upon these classifications fail to quantify the severity of the wounds. Investigators have also found that type of weapons cannot be identified in significant number of cases.

Aim: To determine the incidence of infective complications in surgically treated civilian gunshot wounds and its correlation with Red Cross Classification system in civilian practice.

Materials and methods: Between August 1998 and September 2003, 52 patients under went surgical treatment for gunshot wounds to extremities at this regional plastic and reconstructive unit. There were 45 men and 7 women with 35 upper limb and 17 lower limb gunshot wounds. Age of the patient ranged from 12 to 53 years with median age of 24 years.

Results: Thirty-eight patients had grade-1 wounds. None of these patients developed wound infections. Among six patients with grade-2 wounds one patient developed infection. Eight patients had grade-3 wounds. Five of these patients developed wound infections.

Conclusions: Majority of gunshot wounds to extremities in civilian practice are Red Cross grade-1 and they are associated with very low incidence of infective complications. Gunshot wounds of grade-3 and type VF needs most aggressive approach, as they are associated with highest incidence of wound infections. We recommend that civilian gunshot wounds should be classified according to Red Cross Classification system for deciding their early management.

Proximal humerus fracture in the osteoprotic bone: should one use a nail or plate device?—a biomechanical study

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Aim: To compare of strength of constructs using the newer and part specific nail systems: Polarus and European Humeral Nail with that using PHILOS and Conventional plate systems in a simulated two-part fracture of proximal humerus, in an osteoporotic bone model.

Materials and methods: A Biomechanical laboratory study was undertaken. Third generation composite Humerus model was used, with short e-glass epoxy fibres forming cortex and polyurethane cancellous core. Low-density polyurethane core (1.2 g/cm^3) was used to simulate an osteoporotic model. Osteotomy at surgical neck of humerus was carried out to create two-part fracture of proximal humerus. Samples were fixed using one of the implants—the Polarus Nail, the European Humeral Nail, PHILOS Plate, Clover Leaf Plate or T-Plate. Following fixation samples were placed in a custom made jig to fix proximal and distal ends without interfering with implants and osteotomy site.

All samples were subjected to cyclical torque, torque to failure, cyclical compression and compression loading to failure.

Results: The two nail systems that are specifically designed for proximal humerus fractures provided significantly better fixation in all the test modalities. PHILOS construct shows less plastic deformation in cyclical torque and cyclical compression

when compared to the other plates but the two nail systems were far superior. Locking screws did not 'back off' in any of the experiments involving the Polarus, European Humeral Nail and PHILOS construct, however ordinary screws used with the conventional plates did back off both in 'torque and compression' testing.

Conclusions: Polarus and European Humeral Nail constructs provide better stability in torque and compression as compared to PHILOS, which in turn is a more stable construct in comparison to conventional plating devices. This however is a purely biomechanical conclusion and needs to be further investigated with clinical trials.

Whiplash—what are the levels of symptoms and neck movements at 9.5 years. A controlled study

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A study was performed to see if chronic symptoms and a decrease of range of movements occur after whiplash injuries, a great deal of variation being noted in the literature with some suggesting that this condition is self-limiting and some suggesting regular chronic symptoms in a proportion. One hundred and sixty-six participants took part in the study. Fifty-five participants had a previous road traffic accident with neck pain for a time, mean age 46.0 years. We reviewed them at a mean of 9.5 years after injury. Mean neck rotation was 142.8°, flexion—extension 86.2° and lateral flexion 68.9°, 56.2% suggested pain with the mean being 43 mm (range 16—75 mm) on a visual analogue scale. In a control group with no previous arthritis, accidents and no previous neck pain, consisting of 59 participants, with a mean age of 47.4 years, rotation was 153.0°, flexion—extension 91.1° and lateral flexion 73.9°. Eighteen participants reported a car accident with no injury and no previous neck problems, mean age 46.4 years, rotation was 155.8°, flexion—extension 89.9° and lateral flexion 73.2°, the same as the control. 32.5% of the whole group stated they had previous neck pain, of the group with no previous whiplash injury or known arthritis, 22% complained of neck pain ($n = 24$), with the mean being 38.9 mm (range 10—84 mm) on a visual analogue scale, rotation was 142.8°, flexion—extension 86.2° and lateral flexion 68.9°. Our group with only neck arthritis ($n = 7$) faired the least well, rotation was 110.3°, flexion—extension 61.0° and lateral flexion 52.6°, VA 53 mm. Other demographic variable are discussed. We conclude that a greater proportion of whiplash subjects will note symptoms greater than various control groups ($p < 0.001$) 9.5 years after injury.

Remanipulation rates after reduction of distal radius fractures under haematoma block in the emergency department

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Distal radius (Colles') fractures are very common and can be reduced under different types of anaesthesia, including haematoma block in the emergency department.

Aims: Analysis of remanipulation rates with this method and to determine any predictive factors that make remanipulation more likely.

Methods: For the year 2002, 72 cases were identified, with analysis of radiographs, emergency department records and orthopaedic notes.

Results: Thirty-one (43%) required further procedures performed under general anaesthetic after orthopaedic review, as follows: manipulation only (1), manipulation with Kirschner wire (24), ORIF (3) and external fixation (3). Remanipulation rates were significantly lower if the fracture was angulated 20° or less (25%, $p = 0.047$), with statistically weaker improved results if the patient was aged 80 or over (30%, $p = 0.24$), extra-articular (37%, $p = 0.26$) and if performed by a senior clinician (33%, $p = 0.53$). The degree of shortening and presence of comminution made no difference.

Conclusions: The overall remanipulation rate of 43% (31/72) does compare unfavourably with other studies using haematoma block, which had rates of 9% (7/79) and 24% (17/70). Various changes in practice could be considered to improve outcome. These could include more direct senior and orthopaedic involvement, especially in more severely angulated and intra-articular fractures, and improved training for junior casualty officers. Alternative anaesthetic methods such as Bier's block and dedicated general anaesthetic wrist fracture lists are reasonable alternatives.

Experience with the Targon PF nail

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Intramedullary nails for proximal femoral fractures have undergone many developments in recent years. The first generation nails, such as the Zickle nail had technical problems of nail insertion requiring open procedure and a risk of femoral fracture when nail was removed. Second generation implants such as the Gamma nail and IMHS were developed to overcome these problems and are easier to insert and have the facility of distal locking. These nails brought new complications, particularly those of operative fracture of the femur and later fracture around tip of the implant. The next generation of proximal femoral nails such as the Targon PF nail are undreamed; solid implants and made of titanium that is more flexible. These nails are thinner in diameter (10 mm) with tapered tip, have dynamic distal locking, an anti rotation pin and barrel for the lag screw to reduce the risk of jamming. Both barrel and pin are fixed to the nail to prevent migration of pin or barrel laterally or medially. We present our experience with this implant.

One hundred and twenty-six patients with a proximal femur fracture were treated using the Targon PF nail. The mean age of the patients was 80 years (range, 20—99), 29 were male. Thirteen fractures were stable-trochanteric, 52 unstable-trochanteric fractures, 18 reversed fracture lines (A3), 42 subtrochanteric fractures and one hip and femoral shaft fracture. Eleven of these fractures were pathological. Mean X-ray follow-up was 146 days.

Fifty-one nails were 'long' Targon PF nails and the remainder the standard 220 mm length. The mean length surgery was 65 min. Fifty-five patients required a blood transfusion with a mean of 2.2 units blood. Mean hospital stay was 21 day (range, 2—174). Operative complications that occurred were two fractures needed open reduction and one femur needed reaming. In addition, 12 fractures had difficulty proximal locking and four difficult distal locking. During follow-up two fractures self-dynamised and three were electively dynamised by screw removed under local anaesthesia. All fractures healed and no revisions or secondary anaesthetics were required.

In this prospective study to date our experience with the Targon PF is favourable. There has been no fracture healing complications and there have be no cases of fracture around the implant.

Osteoporosis and fragility fractures—underrated and under diagnosed

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Background: Osteoporosis is 'silent' until fracture occurs. One in two white women will suffer a fragility fracture in her lifetime. Postmenopausal women who have sustained a distal radial fracture have nearly twice the risk of a hip fracture. The referral rate of patients with fragility fractures is not previously reported from Wales.

The guidelines recommend that an evaluation for osteoporosis be performed on all postmenopausal women who present with fracture, using bone mineral density (BMD) testing to confirm the diagnosis and to commence treatment to reduce the risk of future fracture.

Aim and objectives: The purpose of this study was to evaluate the referral rate in women aged 50 and above, following a fracture of the distal radius in a district general hospital in Wales.

Methods: A retrospective cohort study was performed with the use of the accident and emergency database to identify all women aged 50 and above who sustained a distal radius fracture between January and December 2003. Case notes were reviewed as appropriate.

Results: There were 182 patients in this category who were treated for distal radius fractures and were followed up in fracture clinic. Twenty-two patients (12%) were referred to rheumatology clinic for BMD measurement and possible treatment of osteoporosis.

Conclusion: The current practice is inadequate for the diagnosis of osteoporosis in high-risk women. A multicentric study may be performed to identify the average referral rate for high-risk women to quantify the problem, which will enable us to set up strict guidelines as supported by the British Orthopaedic Association.

Preserving the short external rotators during hemiarthroplasty of the hip using the posterior approach: an anatomical study

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This anatomical study examines in detail the trochanteric insertions of the short external rotators into the greater trochanter of the femur. The aim was to improve the stability of the posterior approaches by developing an osteotomy, preserving

the tendon insertions, for reattachment and/or to gain maximum length of the tendons for repair.

Twenty-nine femurs from 15 cadavers were prepared: the position of the insertions and the cross-over angle of the Piriformis and Obturator Internus tendons were recorded from the back to the front on the greater trochanter, expressed as a percentage of the total distance.

Piriformis inserted at an average of 55% along the way of the trochanter into its medial edge of the superior surface. Obturator Internus is inserted at an average of 63% along the trochanter and inserts onto the anterior and superior aspect of the greater trochanter. In 21 specimens, the tendons were separate; in 5 specimens, the tendon of the Piriformis enclosed the tendon of the Obturator Internus; and in 3 specimens, the tendons were fused.

Osteotomies of the posterior half of the greater trochanter to reattach the short external rotators must be ineffective, as our study shows that these tendons invariably insert in the front half of the trochanter.

We have modified our posterior approach by initially dividing the Obturator Externus. Subsequent dislocation in flexion, adduction and internal rotation of the hip exposes the anterior aspect of the greater trochanter, allowing the Obturator Internus to be divided at its insertion with preservation of the Piriformis. Anterior insertion of these tendons allows free access to the more posteriorly placed Piriformis fossa. At closure, the tendon of the Obturator Internus is woven into the tendon of the Piriformis.

Mechanical testing of bioresorbable screws and plates

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Introduction: Bioresorbable screws have been tested in single shear and pull-out and developmental versions of the plates have also been tested and compared to metal counterparts. Both of these sets of tests were performed in standard dry laboratory conditions. Since the screws and plates are going to be used, it was decided to perform the testing in a warm and wet environment. We performed the plate four point bending and screw shear tests.

Materials and methods: The standard test method used was soaking and testing the plate in aerated, flowing water at 37 °C at a cross-head speed of 2 mm/min with the 50 N load cell. The deviations from this test method were: not soaking the plate and testing dry at room temperature, testing at a speed of 10 mm/min and testing plates that had soaked in the solution at 37 °C for 28 days.

Screws were tested until destruction at 2 mm/min, with the others being tested at 10 mm/min.

Results: When tested dry, the plates were on average 18% stiffer (not statistically significant, $p = 0.43$), had a 89% higher 0.1 mm offset strength and a 75% higher peak load. Both of the differences in strength were statistically significant (t-test, $p < 1\%$).

Plates that had been degraded for 28 days had a stiffness of 23.6 ± 4.3 N/mm, which is on average 67% of the stiffness of the new plates, under the same test conditions. They had a peak strength of 13.0 ± 2.2 N, i.e. they had on average 39% of the strength of the new plates. Both these differences were statistically significant (t-test, $p < 5\%$). The 3.5 mm degraded screws had 67% of the strength of their new counterparts and the difference was statistically significant (t-test, $p < 5\%$). The 5 mm degraded screws held 95% of the strength of their new counterparts and the difference was not statistically significant. The stainless steel 3.5 mm screws had 2.4 times the strength of their ReUnite counterparts and the stainless steel 4.5 mm screws were 69% stronger than the 3.5 mm stainless steel screws.

Conclusions: Degradation of strength was most prevalent on the plates (39% remaining). The 3.5 mm screws had their strength degraded to 67%, whereas the 5 mm screws were hardly affected.

Plate bending testing revealed that LactoSorb is highly dependent on temperature and test speed. As expected, metal plates and screws were far stiffer and stronger than similar sized ReUnite components.

Epidemiology, outcome and complications following operative management of Clavicular non-union

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Aim: To find out the epidemiology, outcome and complications following internal fixation of symptomatic Clavicular non-union.

Material and methods: Twenty Clavicular non-unions treated between March 1998 and March 2004, the data was collected prospectively and retrospectively analysed. Out of these, 18 were males and 2 were females, with average age was 39 years {range, 23—51 years}. Fracture pattern

varied from Allman type I in 10, type II in 4 and type III-in 6 cases. The data was analysed for mechanism of injury, time to surgery, time to clinical and radiological union. All these patients were then requested to fill in a Quick-Dash questionnaire to assess their outcome.

Results: The median time to internal fixation was 6 months from the time of injury. Average follow-up is for 32 months (range, 3—77). Surgical intervention included reconstruction plate in 10 patients, hook plate in 6 and LCDCP in 4 patients. All the patients had autograft from iliac crest with internal fixation. Two patients had implant failure needing further internal fixation and bone graft. The median time to radiological union was 4 months (range, 2—17 months). Complications included failure to unite in one patient who did not want further surgery, two implant failures, paraesthesia in the upper limb in two patients and paraesthesia along the lateral cutaneous nerve of the thigh in one patient and. Three patients had their metal work removed because of local discomfort after fracture union. A detailed discussion of our results and implications to current practice will be presented.

Outcome following the use LISS plating for periarticular knee fractures—combined experience of two hospitals

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Aim: To find out the clinical and functional outcome and complications following the use of LISS plating for distal femoral and proximal tibial fractures and non-unions.

Methods and materials: This is a prospective study between Kings College Hospital, London and Brighton and Sussex University Hospital. The study period was between October 2002 and May 2004. We identified cohort of 31 patients out which 25 were acute injuries and six were non-unions. Five out of six non-unions were from the distal femur. The average age of the patient was 42 years {range, 17—88 years}. Our male:female ratio was 1:1.5. The common mechanism of injury was road traffic accident. All the fractures except one (Gustillo-Anderson type-I) were closed injuries. Six patients had multiple injuries and the rest were isolated injuries. All these patients had a proforma attached to their notes. The data was analysed for intra-operative details including the use of bone graft and Ossigraft (BMP 7), length of stay, complications, time to clinical and radiological union. We then assessed the functional outcome by using both SF-12 (short form) and International Knee Society Scoring System.

Results: Average length of follow-up was 6 months. In addition to LISS plate fixation, 15 patients had auto graft from iliac crest and 2 had ossigraft (bone morphogenic protein 7). Average length of stay in the hospital was 19 days. One patient who had previous infective non-union developed abscess post-operatively and this settled with debridement, antibiotics and Vac-therapy. One patient had broken LISS plate used for tibial plateau fracture at 10 weeks post-operatively. One patient needed removal of the plate following femoral non-union due to local discomfort. We present our early results and its implications in the management these difficult fractures.

A study of the functional and radiological outcome of posterior wall fractures of the acetabulum treated surgically, comparing those with and without marginal impaction of the articular surface

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Introduction: The presence of marginal impaction implies greater compressive injury to the articular surface of the acetabulum and such impaction has been postulated to worsen the prognosis of acetabular fractures. Aim of this study was to compare the functional and radiological outcome in patients with fractures of the acetabulum involving the posterior wall, in which there was marginal impaction of the articular surface and in those with no marginal impaction.

Materials and methods: A retrospective study was performed on all patients who underwent open reduction and internal fixation of all acute fractures of the acetabulum involving the posterior wall following admission to the pelvic trauma unit at Frenchay Hospital, Bristol. From December 1995 through May 2002, 47 patients underwent open reduction and internal fixation of an acute fracture of the acetabulum involving the posterior wall with associated hip joint instability. The mean duration of follow-up was 39 months (range, 12—84 months).

Results: The quality of reduction of the acetabular fracture measured using radiographs was graded anatomic in 28, imperfect in 2 and poor in 2 patients. Quality of reduction was also assessed using the post-operative computerised tomography scan. Anatomic reductions were only seen in 8 patients, with satisfactory reduction in 20 and poor reduction in 4 patients. The clinical outcome, at a

mean of 39 months (range, 12—84) following surgery, was graded as excellent in 4 patients, very good in 8, good in 10, fair in 5 and poor in 5 patients, using the modified Merle d'Aubigne score of Matta.

Conclusions: Post-operative CT scans were more accurate than radiographs alone in assessing the quality of reduction. Good reduction of area of marginal impaction and posterior wall can be achieved by open reduction and internal fixation. The reduction in the areas of marginal impaction and posterior wall is maintained through to union of the fractures. Late remodelling or resorption was seen in only two cases. Clinical and radiographic outcome is good following open reduction and internal fixation of acetabular fractures with posterior wall involvement in short-to-medium term with 69% excellent-to-good clinical and 80% excellent-to-good radiographic outcome.

Outcome and complications following operative management of Schatzker VI tibial plateau fractures—experience from a limb reconstruction unit

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Aim: Our aim is to find out the clinical and radiological outcome and complications following the surgical management of Schatzker VI tibial plateau fractures.

Methods and materials: Between September 1999 to April 2004, 14 patients presented to our unit with severe tibial plateau fractures (Schatzker VI). The data was prospectively collected and analysed retrospectively. Out of these, eight patients were males and six were females. The average age was 40 (range, 33—82 years). Four patients had multiple injuries and had open fractures, the other 10 were isolated closed injuries of the tibial plateau. Surgical intervention included Ilizarov ring fixator in 11 and LISS plate in 3 patients. We analysed the data for mechanism of injury, complications related to the injury and surgery, time to clinical and radiological union. All the patients were then sent SF-12 (short form) and International Knee Society scoring system to assess the functional outcome following the surgical intervention.

Results: The average follow-up is 2 years (range, 3 months—5 years). The average time to radiological union was 20 weeks (range, 12—30 weeks). The average length of stay in the hospital was 38.5 days. The average time to full weight bearing was 147 days (range, 84—225 days). Seven patients had auto graft from iliac crest and two had ossigraft (bone morphogenic protein 7). Average time to clinical union was 121 days. Average time to radiological union was 159 days. On radiographic assessment the tibio-femoral angle ranged from 15° varus to 12° valgus (median, 3° valgus). The articular congruity ranged from 10 mm depression of the lateral tibial plateau to 15 mm of the medial tibial plateau without clinical varus or valgus instability. Four patients had grade 2 pin site infections, which settled down with oral antibiotics. A detailed discussion of our results and implications to current practice will be presented.

The use of the Fixion expandable intramedullary nail in pathological and osteoporotic long bone fractures

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Introduction: We present our preliminary clinical experience of an expandable 'self-locking' intramedullary nail for the fixation of pathological and osteoporotic long bone fractures. This innovative system obviates the need for interlocking screws in poor quality bone.

Methods: The 'Fixion' nail has been used in our Trauma Unit since February 2000. The nail is composed of four longitudinal bars connected by a membrane and sealed by a unidirectional valve. The collapsed nail is then inflated with saline under controlled pressure using a hand pump. When expanded the longitudinal bars abut along the entire length of the inner surface of the intramedullary canal, thus fixing the fracture. All nails were inserted using the recommended technique. Data were collected on patient co-morbidity, intra-operative and post-operative complications and outcome.

Results: Nine nails were inserted—seven humeral nails (four metastatic fractures), one tibial nail and one femoral nail. The mean age of the patients was 70 years (range, 53—89 years). The mean operation time for the humeral nails was 62 min. Good fracture reduction was achieved in all but one case where there was implant failure. All patients with humeral nails were able to mobilize comfortably in the immediate post-operative period. No infections were reported. Reduction was maintained, without rotational malalignment, in all of the patients.

Conclusion: The 'Fixion' nail offers a number of advantages in the treatment of challenging long bone fractures, particularly in patients with signifi-

cant co-morbidity. The procedure is minimally invasive, and allows good fixation in poor quality bone. The system reduces operating room time and radiation exposure for both the surgeon and patient while achieving stable fracture fixation and early functional return.

Variables affecting stability of distal radius fractures fixed with K wires: a radiological study

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Aim: To identify the variables associated with poor radiological outcome in the distal radius fractures stabilized with K wires.

Materials and methods: All the patients who underwent K wire fixation of distal radius fracture in last 3 years were included in this retrospective study. AO classification was used to classify the fracture. Immediate post-fixation radiographs and radiographs taken just prior to removal of K wires (5—6 weeks) were analyzed to study three radiological parameters (dorsal tilt, radial tilt, ulnar variance). Changes in these parameters were recorded. Results were graded as excellent, good, fair and poor according to the Stewart classification. The results were analyzed against variables like age, sex, AO classification, associated ulnar fracture, number of K wires used, delay in fixation and duration of fixation. Statistical tests were performed to find out variables associated with the poor radiological outcome.

Results: One hundred and thirteen distal radius fractures were analyzed in total. Average age of patients was 56.2 years (standard deviation, 19.9) with male to female ratio of 1:2.1. Average loss of radial tilt was 4.12°, loss of dorsal tilt was 8.07° and change in the ulnar variance was 3.12 mm. We found excellent results in 23.9%, good result in 56.6%, fair results in 15% and poor results in 4.4% of patients.

Age more than 65 years (p-value, 0.006), comminuted distal radius fracture [A3 or C3 in AO classification] (p-value, 0.049) and associated ulnar fracture (p-value, 0.013) were the variables found to have statistically significant correlation with poor radiological outcome.

Conclusion: Age more than 65, comminuted distal radius fracture and associated ulnar fracture are the variables associated with poor stability of K wire fixation in distal radius fracture. Alternative mode of stabilization should be considered to improve the stability of the fracture fixation in these patients.

Fractures of the pelvic ring and the hip due to a fall—are they mutually exclusive?

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Background: Non-weight bearing hip is a common problem in the elderly population after a minor fall. Magnetic resonance imaging (MRI) is used to diagnose occult fractures in the hip and the pelvic ring in these individuals. The aim of this study is to find the relationship between the incidence of occult fractures in the hip and that in the pelvic ring following low velocity trauma in the elderly.

Material and methods: Between January 2000 and February 2004, 106 elderly patients (mean age = 81.4 years; range = 67—101 years), underwent an MRI scan of the pelvis and hip to rule out fracture neck of femur. All of them presented with a non-weight bearing hip after a history of low velocity injury. All had standard radiographs of the pelvis and the hip which did not reveal a fracture of the femoral neck. However, eight patients had fracture of the pubic rami visible on plain radiographs. MRI scans were subsequently performed in all of them to rule out an occult fracture of the femoral neck.

Results: Out of the 106 patients, 17 (16%) had intracapsular neck of femur fracture, 26 (24.5%) had extracapsular neck of femur fracture, 26 (24.5%) had pubic rami fracture, 17 (16%) had sacral fractures, and 37 (34.9%) had no fractures. All the sacral fractures occurred in patients with pubic rami fractures. Further except in one patient where the pubic rami fracture and the sacral fracture were contralateral, the remaining 16 patients had ipsilateral pubic rami and sacral fractures. None of the patients with pelvic ring fracture had associated femoral neck fracture.

Conclusion: Inability to weight bear after a fall is a common presentation in the elderly population. Falls can lead to fracture neck of femur or a fracture of the pelvic ring but seldom both. We can also conclude that in an elderly patient with low velocity injury, if a pelvic ring fracture is detected in the plain radiograph there is no indication for further MRI to rule out femoral neck fracture. Further, the fracture in the anterior and posterior pelvic ring commonly involves the same side than the contralateral side, in the elderly after trivial trauma.

Closed reduction of Colles' fractures—what is best? Haematoma block or IV sedation

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Aim: To assess the adequacy of reduction of Colles fracture by haematoma block and intravenous sedation and its outcome.

Methodology: Retrospectively reviewed 70 Colles fracture reductions done in the A&E; 30 haematoma blocks and 40 intravenouss sedation. The prereduction radiographs were reviewed for the radial height and inclination and dorsal tilt. The outcome of the reduction was also reviewed.

Results: The mean age was 59 years for haematoma block and 56 years for intravenous sedation. Fracture classifications were similar in both groups using the Frykman and Universal classification. The mean prereduction radial length, radial inclination and dorsal tilt were equal in both groups. There was significant difference in post-reduction measurements between the two groups. Of the haematoma block group, 30% had further manipulation and K wiring done whereas only 15% of the intravenous sedation group had further procedures done.

Conclusions: Our study showed that there was less remanipulation and better reduction in the intravenous group than the haematoma group. We recommend intravenous sedation as a preferred procedure for initial manipulation of Colles fractures for a better outcome

Is two views too many? A new X-ray protocol for fractured neck of femur patients
Submitted for poster or podium presentation

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Introduction: Fractured neck of femur is a common orthopaedic presentation, and most hospitals employ a ''fast track'' system where patients undergo routine imaging (AP pelvis, lateral hip) prior to orthopaedic referral. Do all patients need to undergo the same imaging?

Method: Retrospective assessment of admission radiographs of all #NOF admissions over a 3-month period in a district general hospital. Films assessed and correlated with operative procedures by two observers.

Results: Fifty-four patients were identified from admissions records and radiographs were obtained for 44 patients. Twenty-two patients had extra-capsular fractures, the remainder were intra-capsular; of these, 3 were undisplaced (Garden 1 or 2) and 19 were displaced (Garden 3 or 4). Repeat views were required in 11 (25%) cases due to a poor AP film and 4 (9%) cases due to a poor lateral film. Of the 22 extra-capsular fractures, 18 patients were treated with a dynamic hip screw (DHS) and 1 patient required an intramedullary hip screw (IMHS). Of the 19 displaced intra-capsular fractures, 18 received hemi-arthroplasties. Of the three undisplaced intra-capsular fractures, two were treated with a short-plate DHS and de-rotation screw and one received a hemi-arthroplasty. Three patients died prior to surgery and one was treated conservatively.

Discussion: Accepted wisdom is that two perpendicular radiographs are indicated if a fracture is suspected. Although an AP pelvis is straightforward to obtain, a lateral view to show the femoral head, neck and shaft is technically demanding and may require several exposures, especially if the patient is in pain, has contra-lateral hip arthritis or is uncooperative. In the vast majority of cases, the fracture pattern is either extra-capsular (requiring internal fixation with a DHS or IM nail under screening in theatre) or intra-capsular but displaced (requiring hemi-arthoplasty or primary total hip arthroplasty); in both cases, the initial lateral view makes little difference to the treatment. We would, therefore, advocate that a lateral view is only routinely taken in (a) undisplaced or minimally displaced intra-capsular fractures, (b) patients under 60 in whom reduction and fixation is desirable or (c) where no fracture is obvious on the AP film.

Misplacement of chest drain in acute chest injuries—CT scan interpretation of 61 chest drains

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Aim: To determine the misplacement rate in chest drain insertion in acute chest trauma in a major trauma unit by CT assessment of the chest.

Materials and methods: Clinical records and chest CT scan reports of 43 consecutive patients who had chest drains inserted in the emergency room and followed by CT scan of the chest were reviewed retrospectively. The total number of chest drains inserted was 61. Subsequently, the scans were reviewed by three radiologists of varied experience and seniority, a trainee and two consultant radiologists.

Results: Sixteen drains were confirmed to be in the extra-pleural space (15 in lung parenchyma and 1 in the soft tissues) by the trainee (L.S.) and a consultant (C.W.) and 12 drains to be extra-pleural

(11 in the lung parenchyma and 1 in the soft tissues) by a consultant chest radiologist (J.R.). Only 10 of them were recorded to been either replaced or repositioned. Six clinical complications were recorded.

Conclusion: Chest drain insertion in emergency room for acute chest trauma can be associated with high rate of misplacements, 30% in our study confirmed by CT chest. The procedure should always be undertaken or supervised by a clinician or surgeon with necessary expertise.

Ankle fractures: impact of timing of surgery on hospital stay and resources

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Aims: To ascertain the impact of timing of ankle fracture surgery on length of post-operative and total hospital stay and its implication on resources.

Methodology: Audit of consecutive ankle fractures that underwent open reduction and internal fixation at Newcastle General Hospital over a 4-year period. Data collection from theatre records, PAS system, case notes and radiographs was undertaken and entered in SPSS database.

Results: Four hundred and thirty-one cases of ankle fracture fixation were included in the study. These included 40.9% ($n = 173$) female and 59.9% ($n = 258$) male patients. Mean age of the patients was 39.1 years (S.D. $\pm$ 17.8) with minimum age of 6 years and maximum 89 years.

Two hundred and ninety-eight patients were operated within 48 h of admission (early surgery group), and 136 patients after 48 h (delayed surgery group). The mean hospital stay in the early operation group was mean 5.3 days (S.D. $\pm$ 4.9) and in the delayed surgery group it was 12.2 days (S.D. $\pm$ 8.4). The patients who were operated early had shorter total hospital stay ($p < 0.001$) and also had shorter post-operative stay ($p < 0.05$). Increasing age and female gender appeared to predispose to longer hospital stay but not significantly. Mean age, gender and ASA grade, fracture class and operating surgeon's grade distribution were not significantly different in the early and late surgery groups.

Each patient in delayed surgery group spent an extra 6.9 days in hospital stay compared to the early surgery group, translating into an extra 937 hospital bed days. The delayed surgery group resulted in added expenditure of £192 085 to the trauma division solely for extra hospital stay.

Conclusion: Timing of surgery in ankle fracture appears to be the most significant determinant affecting the hospital stay. This has a significant resource implication, both financially and in freeing up the hospital beds.

Early results using the philos plate system for proximal humeral fractures

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Introduction: Fractures of the proximal humerus account for 4—5% of all fractures. Most occur in elderly individuals caused in part by osteoporosis. The treatment of displaced fractures is controversial. Conservative treatment frequently leads to poor outcomes because of malunion and stiffness. ORIF is increasingly advocated. Biomechanical studies suggest that the Proximal Humeral Internal Locking System (PHILOS) provides better fixation than conventional plating devices in osteoporotic bone.

Aims: The aim of this study was to assess the early results of surgical treatment of displaced 2, 3 and 4 part proximal humeral fractures using PHILOS.

Methods: All patients who underwent ORIF of their proximal humeral fracture with PHILOS were followed up for a period in excess of 6 months. The initial injury was classified according to the AO system. At follow-up, functional outcome was assessed using the Oxford Shoulder Score and X-rays were performed.

Results: Twenty-six patients were included in the study. The mean patient age was 52.5 years (S.D. $\pm$ 19.2) and 15 (58%) were females. All patients underwent treatment for acute fractures. According to AO classification, there were four cases of 11C2, three of 11B1, two of 11B2, one case each of 11C3, and 11B3, and the rest were 11A3 fractures. All fractures united in $<$6 months, mean time to radiological union was 12.9 weeks (S.D. $\pm$ 5.7). At a mean 24.1 weeks post-surgery, the mean Oxford Shoulder score was 23.4 (S.D. $\pm$ 6.5).

Complications were few and included one death secondary to CCF, one superficial infection, and stiffness of shoulder in two patients, one of whom needed MUA. There was one case where there was loss of reduction of the fracture due to screw back out and was revised with another PHILOS plate.

Conclusion: The PHILOS plate system is a safe and effective treatment of displaced proximal humeral fractures. Functional outcomes are high and complications after surgery are low if correct technique is used.

Monitoring training standards of orthopaedic trauma surgery—how effective is the SAC system

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The Joint Committee of Higher Surgical Training (JCHST) sets the standards for Higher Surgical Training in Trauma and Orthopaedics. To ensure that the training units adhere to these standards, visits of inspection are carried out by the Specialist Advisory Committee (SAC) in Trauma and Orthopaedics. These are used to either accredit or withdraw training from the training units.

Standards for training units were laid down in February 2001 detailing the various criteriae against which individual units and training programmes would be assessed by quinquennial and interval SAC visits of inspection. These standards took into account training programmes, facilities for the trainee, firm structure, trainee timetable and educational support.

We present a study on the performance and effectiveness of the SAC inspection visits process by reviewing the visit reports. The aim of this study is to evaluate the efficiency and effectiveness of the SAC visit/report process, to identify the areas of compliance and non-compliance of the units and the key local service pressures on the training.

The period of study was from February 2001 to December 2003. Only regions in which most of the units had completed the report process were included in this study (113 units, with 110 quinquennial visits, 28 follow-up visits and 31 progress reports involving interviews of 439 higher surgical trainees).

For each unit, the agreed reports from all visits and revisits were reviewed and scored against the published SAC Standards by a single researcher without prior knowledge of the SAC function.

This study highlights the importance of the current visits process, and offers a critical analysis of the trauma surgery training and the implications for planned changes in training governance with the formation of PMETB.

Ultrasound as a pre-selection tool for Achilles tendon rupture management

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Aim: To determine whether gap determination by dynamic ultrasound is useful in selecting the appropriate treatment for Achilles tendon rupture.

Introduction: Ultrasound has been used in diagnosis of tendon rupture, supporting different treatments. The main complication is tendon re-rupture. Previous studies have not extended the role of ultrasound beyond diagnosis of the site and the type of rupture, towards decision-making between operative and cast treatment. In this study, patients with a residual gap ($>$5 mm) in equinus were treated by surgical repair, those where the tendon ends were opposed in equinus were treated by a splint regime (Sheffield).

Method: The records of 94 patients treated, over a period of 3 years were analysed. Recorded data included the clinical assessment, ultrasound scan measures of tendon gap in equinus, treatment decision (percutaneous repair, open repair or splint regime), complications, re-rupture rate and follow-up to a minimum of 6 months.

Results: Seventy-six males and 18 females entered the study (a total of 94 ruptures). The 17 that had tears at or near the musculotendinous junction were excluded. Forty-four (60%) had a gap and surgery (two with a gap were treated non-operatively because of co-morbidities excluding surgery). Twenty-nine (37%) with no gap were treated by splintage, two patients with no gap preferred surgery. Twenty-one, therefore, had percutaneous repairs and 25 had open repairs. There were two re-ruptures (6.4%) in the non-operative group and one DVT. In the operative group, there were no re-ruptures, three infections (6.5%) and two with sural nerve symptoms.

Conclusions: This early report of a dynamic ultrasound directed protocol for the treatment of acute Achilles tendon rupture suggests potential optimisation of care (by a low incidence of re-rupture) by specific allocation of patients to operative and splint treatments based on the persistence of a tendon gap in equinus.

A review of 104 metastatic pathological hip fractures

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The proximal femur is the most common site for metastatic deposition in a long bone. This often leads to fracture of the proximal femur whether spontaneously or following a fall. We report on the 104 cases of pathological metastatic fractures of the proximal femur that have presented to our department since 1989.

Forty-eight males and 56 females presented with an average age of 72 years (range, 42—96). Average survival following operation was 287 days

Table 1

Primary pathology (carcinoma)	Number (%)	Average age at operation	Average survival post-operation (days)	Revisions
Breast	39 (38)	69	437	6
Prostate	25 (24)	78	157	2
Lung	12 (12)	69	76	1
Lymphoma	8 (8)	75	264	1
Myeloma	5 (5)	70	456	0
Bowel	2	69	113	0
Renal	2	72	18	0
Endometrium	1	69	372	1
Bladder	1	67	102	0
Unknown	9 (9)	71	330	1

(range, 2—3053 days) with follow-up at 1 year for those who survived this long. Only two patients are alive today (11 and 3 years later). The primary pathology and mean survival are shown in Table 1. The methods of fixation were sliding hip screw (31 cases with 6 revisions), intramedullary nail (20 cases, 1 revision), hemiarthroplasty (34 cases, 3 revisions), total hip replacement (6 cases, 0 revisions) and parallel screw fixation (12 cases, 2 revisions). Revision of the initial operation was necessary in a total of 12 cases (11.5%), usually due to a further fracture requiring further fixation.

Developments in oncological treatments for these diseases have meant that these patients remain alive for long periods of time. Judicious hip fracture surgery will greatly help to increase the quality of life, reduce pain and prolong mobility following these injuries.

Computer assisted surgery for hip fractures

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Dynamic hip screw (DHS) insertion is a commonly employed procedure for fixation of extra-capsular femoral neck fractures. This procedure is performed predominantly by surgeons under training. Accurate insertion of guide wire is the most vital surgical step in DHS insertion. The positioning of the guide wire is technically challenging and usually a trial and error approach. This is undesirable as it prolongs the operation time, increases tissue damage, increases radiation exposure to both patients and staff and greatly relies on surgical expertise. With a view to improve the accuracy and precision of this particular implant. We have developed a novel Computer Assisted Orthopaedic Surgical System (CAOSS). Aided by fluoroscopy, image guided navigation has been applied to the dynamic hip screw insertion for the treatment of femoral neck fractures.

This system has already been introduced into the operating theatre and has so far been used successfully used on 10 patients for extra-capsular femoral neck fracture. Eight were female and two were male patients. Mean age was 85 years. Mean follow-up was 11.5 months. Mean drop in haemoglobin level was 2.1 g/dl. One patient needed blood transfusion. Six fluoroscopic images were used on average. Average time taken to insert the guide wire was 17.2 min. Mean tip apex distance (TAD) was 17.7 mm. No implant failures were found on follow-up in the entire series. No major complications were observed among this early cohort of patients.

The CAOSS was found to be safe, user friendly, accurate, and reliable for the guide wire placement for DHS insertion in its early clinical application. More importantly, the surgeon is in-charge of decision-making and control throughout the operation. CAOSS for these operations has the following potential benefits: improved patient outcome, improved delivery of treatment, development of new improved surgical procedures and reduction in required surgical skill level for these operations.

Kirschner-wire fixation of distal radial fractures: too many complications?

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Background: Stein (1975) publicised the use of Kirschner-wires (K-wires) for the fixation of distal radial fractures, but Chapman (1982) reported a 49% complication rate. K-wires (and Plaster of Paris) is still a very popular treatment for the displaced distal radial fracture.

Method: From our departmental trauma admission database (data being entered prospectively at admission), we identified 67 distal radial fractures which were treated with K-wires, from 2002 to 2004. The mean patient age was 53 (6—92) years.

Results: Thirty-three out of 67 patients (49.2%) were reported to have complications, by the attending orthopaedic surgical team.

Nine patients had more than one complication.

There were four common types of complications:

No. of patients	Complication
9	Pin tract infection
4	Wire loosening or migration
19	Loss of position five cases requiring a second procedure
3	Neurological complication

Conclusion: We demonstrate a high complication rate with K-wire fixation of the distal radius.

There are other methods for fixation of the distal radial fracture with less morbidity.

We propose that the indication for K-wire fixation should be reconsidered and reduced.

Plaster cast immobilisation during air travel Analysis of current practice and aircraft simulated experimental study

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Background: There is an increase in aircraft transportation of patients with lower limb fractures. Current practice is variable and there is no evidence-based literature available. Our aim was to study current practice and to analyse the situation in an experimental simulated aircraft flight.

Methods: Current advice supplied by commercial airline offices in the UK was noted. Postal questionnaires were sent to Orthopaedic Consultants in the UK to obtain their current practice. Experimental aircraft travel was simulated in a decompression chamber with five medically fit volunteers with no fracture, immobilised in an above knee plaster cast. Compartment pressure and venous return was documented and the results analysed in two different positions with the leg elevated and dependant.

Results: Airlines do not have any formal guidelines. Aircraft do not carry tools to remove a plaster if it is required. Orthopaedic consultants in the UK give variable advice in this situation. Sixty percent suggested splitting of the plaster cast during air travel. Experimental study in the aircraft simulation showed that two volunteers developed significant increase in compartmental pressure with the leg elevated to 90°, which settled after the plaster cast was split. There was no change noted in the venous return. There was no increase in compartment pressure noted with leg dependant on the floor with 45° of flexion at hip.

Conclusion: The literature on this issue is limited. With our analysis we feel that patients can be transported with the plaster cast split with a dependant limb free (hip flexion less than 45°). Our volunteers had no fractures so direct comparison with pathological changes in acute fracture is problematical. Further studies into this problem are recommended.

Complications of operatively treated fractures of the olecranon

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We looked at 48 patients retrospectively who had an operative fixation of fracture of the olecranon during a 3-year period. The age ranged from 14 to 87 years.

Seven of the patients had fixation using plate and screws and one of them had excision of the proximal fragment. The remaining 40 were fixed using the technique of tension band wiring.

The most frequently noted complication was prominence of the K-wire, and 79% of the patients, who had >10 mm protrusion of the K-wire from the bone, were symptomatic, while none of the patients with <8 mm protrusion of the K-wire complained. There was a high infection rate of 19% out of which more than 50% were over 70 years. Seventy-one percent of infection led to removal of the implant. K-wire migration was noted in 30% of whom half were without infection and all of the back outs occurred in patients in whom the K-wire had no purchase in the anterior cortex of the ulna. Almost

43% of the patients over 70 years had proximal migration of the K-wire.

Functional evaluation of intra-articular fractures of lower end radius

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Introduction: Distal radius fractures crush the mechanical foundation of man's most elegant tool, the hand. No other fracture has a greater potential to devastate hand function, and no metaphysis of bone is embraced by more precious soft tissues. The functional loading anticipated should influence the choice of method of stabilisation far more than the chronological age of patient. In this study, we assessed the functional end result of the intra-articular fractures of the lower end of radius.

Materials and methods: Between January 2000 and January 2004, 175 patients with intra-articular fractures of the lower end of radius within the age group of 20—60 were included in this study and followed for 2 years. Fractures were classified according to Frykman's classification system. These patients were randomly allocated four different categories of treatment, namely, closed reduction and POP cast immobilisation (50 patients) closed reduction and external fixation (50 patients), open reduction and internal fixation (50 patients) and arthroscopy assisted reduction and fixation (25 patients). Our assessment of functional outcome followed the modified Gartland and Werly system and radiological assessment followed Schieck's criteria.

Results: On evaluation of range of movements of the wrist joint it was found that patients who underwent ORIF and arthroscopy assisted reduction had a better range of movements than other patients. On radiological evaluation, average length of the radial length was 10.41 mm with radial angle being 19.33° and volar tilt being 8.25°. Overall, 70 out of 175 patients had articular step of more than 2 mm following treatment. POP cast group had the maximum number of cases, while arthroscopy group did not have any patients with articular step of more than 2 mm. There were 88 patients with articular step of 1 or less than 1 mm articular step. On evaluation of the final outcome in the closed reduction and POP cast management group, 64% of good to excellent results were found. It was 82% following external fixation 96% following ORIF and 100% in arthroscopy group. Among patient's who had more than 2-mm articular step only 72% patients had satisfactory end result, whereas 95% of the patients who had articular step of 1 or less that 1 mm had good to excellent functional outcome.

Conclusion: We believe that aggressive surgical intervention in these complex fractures is frequently justified, particularly in younger patients. We suggest that up to Frykman type VI fractures without comminution or compounding injury, closed reduction and POP cast immobilisation for 6 weeks gives satisfactory results. In types VII and VIII comminuted fractures, external fixation is an excellent method of treatment to secure a good result. However, with volar displacement subluxation of DRUJ and instability of the fracture open reduction through volar approach and internal fixation is frequently needed. When needed arthroscopy reduction and fixation gives the best possible result.

Arthroscopic assisted reduction and fixation of intra-articular fractures of lower end radius

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Introduction: The rapid expansion of knowledge regarding functional anatomy of hand and wrist and increasing functional demand of patients, athletes and computer professionals in particular and improved methodologies of achieving and maintaining anatomic restoration of these fractures have generated renewed interest in treatment of these fractures. Wrist arthroscopy is increasingly being recognised as an important adjunct in the management of displaced intra-articular distal radius fractures. It provides a more accurate three-dimensional evaluation of joint surface without significant soft tissue dissection. The purpose of this study was to determine the usefulness of arthroscopically assisted reduction of displaced intra-articular fractures of distal radius.

Methods: Between January 2001 and June 2003, 25 patients were treated with arthroscopically assisted reduction for intra-articular fracture of distal end of radius and were evaluated for their clinical, anatomical, functional and radiological outcome and followed for 2 years. Fractures were classified according to Frykman's classification system.

Results: On evaluation of range of motion, these patients, who had arthroscopy assisted reduction,

had palmar flexion of more than 70° and Dorsiflexion of more than 65° with more than 22° of radial and ulnar deviations. Radiological evaluation showed an average radial length of 11.76, radial angle of 20.59 and 9.53 volar tilt. None of these patients had articular step of more than 1 mm. There were 84% of excellent and 16% of good results.

Conclusion: Arthroscopic assisted reduction and fixation is the recommended modality of treatment of intra-articular fractures of distal end of radius. A gap or articular step of more than 1 mm on plain radiograph should not be tolerated and is a definite indication for arthroscopic assisted reduction or open reduction.

Treatment of proximal humeral fractures with the 'PHILOS' plate

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Proximal humeral fractures are common injuries. The majority are undisplaced and can be treated non-operatively. Displaced two part fractures can be fixed satisfactorily by a variety of methods but there is no general agreement on the operative treatment of displaced three and four part fractures.

A new device—Proximal Humeral Internal Locking System (PHILOS)—has recently been introduced to fix these fractures. We have used this implant in 29 patients, majority of which had three or four part fractures. Twenty-six of them were available for follow up, which ranged from 9 to 30 months. Assessment at follow up included radiological review, Constant and DASH scoring.

All fractures except one have progressed to union. None of the patients has shown signs of avascular necrosis of humeral head on X-rays. While recovery of movements and relief in pain was satisfactory, the strength of shoulder did not recover fully in any patient.

One patient needed revision of fixation because the plate broke 8 weeks post-surgery, without any obvious reason. The broken plate was subjected to biomechanical and metallurgical analysis, which revealed that plate is inherently weak at the site of failure.

We also noticed the 'pulling away' of proximal part of plate from bone. Although it did not affect the fracture healing, it may be the reason for 'block' in regaining full abduction and elevation in some patients, who may require removal of plate.

This plate appears to have inherent advantages over other implants due to its shape, low profile and configuration of screws holes. We feel that PHILOS plate is a useful device for fixation of difficult proximal humeral fractures but we are not convinced about its strength. Design of its proximal screws also appears less than satisfactory and may need modification.

Damage control surgery in patients in extremis with unstable pelvic fracture

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Purpose: Severe hemorrhage is the main reason of death in the early phase in polytraumatised patients. Associated unstable pelvic fractures increase the risk of exsanguination. The treatment in these patients "in extremis" requires special attention. Mortality rates up to 90% are reported. A damage control surgery concept in patients with unstable hemodynamics and mechanical pelvis instability is presented.

Methods: Twenty patients with unstable pelvic fractures (OTA: 61-C) and additional hemodynamic instability were treated according to a damage control treatment concept (emergency pelvic C-clamp, immediate retroperitoneal tamponade). Evaluation consisted of demographic data, ISS, concomitant injuries, physiologic parameters, treatment and mortality rate.

Results: All patients suffered from high-energy trauma and were polytraumatised (mean ISS of 37 (17—75)). Sixteen patients were male and four female. The average age was 31 years. All patients had OTA C-type pelvic injury. The average hemoglobin concentration at admission was 6.4 g/dl, the mean base excess −13.4 mmol/l. All patients were in shock (mean shock-index: 2.1). Average transfusion requirements within first hour were 13.5 PRBC. Pelvic C-clamp was applied within 37 min after admission followed by pelvic tamponade within 75 min after admission. Fourteen patients died (70% mortality rate), the expected mortality rate was 80% calculated with the TRISS method. Mortality was neither influenced by the patient's age nor by the severity of concomitant intra-abdominal, chest or head injuries. The cause of death was associated to the pelvic injury in 85%.

Conclusion: Survival of polytraumatised patients with hemodynamic and mechanical unstable pelvic fractures depends on the amount of hemorrhagic

shock. The presented damage control concept of mechanical emergency stabilisation of the pelvis with a C-clamp and hemorrhage control by pelvic tamponade seems to have a positive influence on survival of these patients in extremis.

Functional outcome of surgically treated fractures of the acetabulum

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Objective: To evaluate the functional outcome of surgically treated acetabular fractures and identify possible areas of improvement in our current practice.

Method: Thirty patients, who were surgically treated for an acetabular fracture between 1999 and 2003, were available for follow-up at a mean of 31 months (range 14—58 months) following their injury. Twenty-three were males and seven females. The mean age was 42.9 years (range 21—75 years). Half of the patients had sustained an associated injury, including a femoral head fracture in four. Fracture pattern included 15 simple and 15 associated fractures. The mean time interval from injury till surgery was 9 days. The surgical approaches were: Kocher-Langenbeck (16), ilioinguinal (7), and combined extensile (7). All patients received prophylactically Indomethacin, 50 mg TDS for 3 weeks on average. The quality of surgical reduction was scored from the post-op radiographs, and the functional outcome was assessed by the Merle d'Aubigne score.

Results: The mean hospital stay was 28 days (range 7—90 days) and was related with both the presence of associated injuries and delay for surgery. Ten patients had Sciatic nerve palsy pre-operatively, which recovered fully in six of them. Perfect or near perfect reduction was achieved in 80% of the patients, however, we found no correlation between the radiographic score and clinical outcome. Heterotopic ossification was noticed in one patient and AVN of the femoral head in two. Sixteen patients (60%) had a good or excellent result. Radiographic evidence of osteoarthritis was observed in eight patients and two of them had undergone a hip replacement at the time of follow-up.

Conclusions: Acetabular fractures are high-energy injuries and their clinical outcome is influenced significantly by the comorbidity of associated injuries, and not just a perfect surgical reconstruction. Fracture of the femoral head can be devastating.

Early results of Minimally Invasive Percutaneous Plate Osteosynthesis for fractures of the distal tibia

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Introduction: Fractures of the distal tibia are usually high-energy injuries, frequently associated with severe soft tissue compromise. Minimally Invasive Percutaneous Plate Osteosynthesis is a relatively new technique, developed on the concept that preservation of the soft tissue envelope during surgical management of these injuries is of paramount importance.

Methods: Nine patients (age 21—72 years) with fractures of the distal tibia underwent fixation by MIPO technique for 2 A-type, 3 B-type and 4 C-type fractures according to AO classification. Two fractures were open (both Gustillo Type I). The quality of surgical reduction was scored and the clinical outcome was assessed through the IOWA Ankle-Hind foot Score. The mean follow-up was 12 months (9—17 months).

Results: The radiographic score of surgical reduction was excellent in eight patients. One patient was left with an intra-articular step of 2 mm. There were not any deep infections or any other complications attributed to the procedure. All the fractures united within a period of 9—14 weeks (mean 11 weeks). There was not any leg length discrepancy of more than 1 cm, or any angular deformity of more than 5°. The Ankle-Hind foot score had a mean value of 84 (76—97). All patients were satisfied.

Discussion: Surgical management of distal tibial fractures has always been challenging. Traditional methods of fixation are often fraught with complications, which sometimes may be devastating. Preservation of the soft tissue envelope during surgery cannot be overemphasised. Early reports on fixation of these fractures by MIPO techniques are very encouraging.

Non-operative management of proximal humerus fracture

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Proximal Humeral fractures are common injuries treated in fracture clinics across the UK. Controversy still exists regarding the optimal method of

treatment for these injuries. We present the results of non-operative management of these injuries.

Methods: All the patients were prospectively followed up over a period of one year from the date of injury. They were all treated non-operatively for three weeks in either a collar and cuff or broad arm sling, depending on the treating consultants' preference, followed by physiotherapy. The radiographs were studied for fracture classification and union by a registrar. An independent research nurse evaluated all the functional outcomes at three, six and twelve months.

Results: 70 patients consented to take part in the study. There were 52 females and 18 males. The fractures were classified as 35 non-displaced, 1 frcture through the articulating surface, 12 3-part and 22 2-part fractures. The mean constant score at three months was 50.97 for non-displaced fractures, 37.17 for 3-part fractures and 47.05 for 2-part fractures. At six months, it was 69.50 for non-displaced fractures, 62.00 for 3-part fractures and 64.73 for 2-part fractures.

Conclusion: There was no statistical difference between non-displaced, 2-part and 3-part fractures of the proximal humerus. Patients continue to improve up to, and beyond 6 months post-injury.

Biomechanical testing of locking compression plates: is distance between bone and implant significant?

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Aim: To investigate in vitro the mechanical stability of a locking compression plate (LCP) construct in a simulated diaphyseal fracture of the humerus at increasing distances between the plate and bone.

Materials and method: A series of biomechanical in vitro experiments were performed using Composite Humerus Sawbone as the bone model. Osteotomy created in the mid-diaphyseal region. A 10 mm osteotomy gap was bridged with a 7-hole 4.5 stainless steel plate with one of four methods: a control group consisted of a Dynamic Compression Plate applied flush to the bone and three study groups which comprised of a LCP applied flush to the bone, at 2 mm and at 5 mm from the bone. Standard AO technique used with locking head screws used for LCP fixation.

Static and dynamic loading tests performed in a jig with the bone model fixed both proximally and distally. Samples were subjected to cyclical compression, compression load to failure, cyclical torque and torque to failure.

Plastic deformation and failure was assessed. Scanning electron microscopy of the plate and screw surface allowed detailed inspection of micro-fracture in areas of fatigue.

Results: Consistent results were achieved in LCP constructs in which the plate was applied at or less than 2 mm from the bone. When applied 5 mm from the bone the LCP demonstrated significantly increased plastic deformation during cyclical compression and required lower loads to induce construct failure.

Conclusion: In our laboratory model, a significant decrease in axial stiffness and torsional rigidity becomes evident at a distance of 5 mm between plate and bone.

Influence of weather conditions in the incidence of admissions in an acute orthopaedic ward in a district general hospital

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Aim: To test the hypothesis that the number of admissions in an orthopaedic trauma ward are related to weather conditions.

Materials and methods: Details of all admissions to the orthopaedic trauma ward over 1 complete year were retrieved from a computerised database. Fractures were classified according to the AO classification. Meteorological data correlated with trauma admissions and data analysis using SPSS version 10.1.

Results: Total number of admissions = 1390 [mean age: male = 44.2, female = 67.6 years]. Commonest fractures in descending order: neck of femur, distal tibia and distal humerus. Overall correlation: significantly +ve ($p = 0.013$) with sunshine (more sunshine = more fractures) and significantly −ve ($p = 0.001$) with rain (less rain = more fractures). 34.5% of admissions were non-trauma related.

Conclusion: Females were significantly older than men probably reflecting hazardous activities by younger males and the presence of osteopaenia in females. No significant monthly (seasonal) variations were seen.

Influence of weather conditions:

1. Proximal femoral fracture incidence increase with fall in temperature (freezing conditions

does NOT further increase the risk) and rain (but NOT dependent on the amount of rain).
2. The incidence of forearm and wrist fracture requiring inpatient treatment increases with rain (and is dependent on the amount of rain) and sunshine hours.

A long-term prospective study is required to further support the above findings if clinical trauma resources are to be planned based on predicted weather forecast.

Study to describe the morphology of a series of clavicles and the dimensions of its intramedullary canal

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Aim: A study was done to investigate the range in size and morphological features of a series of human clavicles. Our aim is to develop an intramedullary device for the fixation of displaced middle third clavicle fractures.

Method: A Phillips CT scanner was used to examine morphometric properties of 42 right and 36 left adult cadaveric clavicles. The resulting data was analysed with Voxar 3D software. The length of the s-shaped clavicle was measured and the planar cross-sectional geometry of the intramedullary canal and cortical thickness assessed at 10% increments along the length of the bone. MPR (multiplane reformat) imaging allowed 'fly-through' reconstruction of cross-sectional morphology as one travels along the length of the bone.

Results: The sample studied followed a normal distribution with mean size = 136.2 mm (range 112.6—172.0 mm). In general, the sternal portion of the clavicle is circular or prismatic in cross-section, whereas the acromial portion is flatter on its superior and inferior surfaces. A spacious, variably shaped canal is observed at the sternal and acromial thirds in contrast to the denser, smaller, more circular shaped canal in the central third of the bone. Unlike most long bones, the clavicle was observed to have an extensive network of trabeculae along the entire length of the intramedullary canal. The central third of the clavicle has the thickest cortex. The mean cortical thickness (3.37 mm; range 1.8—7.9 mm) was greatest at a point 60% from the sternal end with the mean thinnest cortex (1.37 and 1.15 mm) found at the extreme sternal and acromial ends of the bone, respectively.

Conclusion: The clavicle is highly variable in shape and exhibits dramatic variations in both curvature and cross-sectional geometry along its length. Contrary to previous teaching, MPR reconstruction accurately demonstrates clear visualisation of a distinct intramedullary canal, which will accommodate an appropriately designed implant.

The risk of local infection following damage control for femoral shaft fractures

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In patients, with femoral shaft fracture, damage control orthopaedics (DCO) entails primary external fixation and subsequent conversion to an intramedullary device (IMN). Contamination of external fixator pin-sites is relatively common and it is argued that a DCO approach may risk subsequent local infective complications.

To investigate this hypothesis, analysis of a prospectively assembled database was carried out, including adult patients with femoral shaft fracture and NISS 20 or more who survived more than 2 weeks. Two groups, damage control (DCO) and early total care (ETC) (1° Nail), were formed. DCO patients were sub-divided depending on the delay prior to conversion (<7 days, 7—14 days, >14 days). Contamination was defined as positive culture from the wound or fixator pin-sites without clinical signs of infection. Superficial infection was positive bacterial swabs and local or systemic signs of infection. Deep infection was any case requiring surgical intervention with a sub-group requiring removal of femoral metal work (ROMW) also defined.

One hundred and seventy-three patients, with 192 fractures (19 bilateral) met the inclusion criteria, mean follow up was 19 months. Patients in the damage control group were more severely injured than those undergoing primary intramedullary nailing (NISS 36 versus 25, $p < 0.05$). There were also more severe (Grade 3 A, B or C) local soft tissue injuries in this group but no other differences in overall demographics. Ninety-eight of the 111 DCO patients underwent subsequent IMN. The others either died after the initial 2-week period without conversion being appropriate or it was elected to complete treatment with external fixation due to complications. The mean time of exchanging ex-fix to a nail was 14.1 days. Infective complication rates are shown in Table 1 below.

Table 1
Infective complications by treatment group and timing of exchange procedure

Group	N	Timing IMN (days)	Contamination		Superficial		Deep		ROMW		Any infection	
ETC	81	<1	3	3.7%	5	6.1%	3	3.7%	2	2.5%	9	11.1%
DCO	111	14.1	14*	12.6%	4	3.6%	6	5.4%	2	1.8%	12	10.8%
<7 days	31	4.3	1	3.2%	1	3.2%	3	9.6%	0	0%	4	12.9%
7–14 days	28	11.1	1	3.6%	0	0%	2	7.1%	2	7.1%	4	14.2%
>14 days	53	23.8	12*	22.6%	3	5.6%	1	1.9%	0	0%	4	7.6%

* $p < 0.05$.

Though contamination rates were higher in the DCO group, there was no excess of infective complications. Contamination increased significantly in patients who underwent conversion to IMN after 14 days. Grade 3 open injury was significantly associated with infection irrespective of treatment.

This study demonstrates that infection rates following DCO for femoral fractures are not significantly different to those observed following primary intramedullary nailing. Whilst the overall risk of deep infection in the DCO group did not show any correlation with the timing of converting the external fixator to a nail, the risk of contamination was higher in patients where the exchange nailing was performed after more than 2 weeks.

Alterations in the systemic inflammatory response following damage control and early total care for femoral shaft fracture

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Recently, in severely injured patients, there has been a move away from early total care (ETC) to staged reconstruction, damage control orthopaedics (DCO). This seeks to limit the magnitude of the 'second hit' insult resulting from operative treatment after trauma, deferring complex reconstructive work until a later stage. For femoral shaft fracture, this entails initial external fixation, to provide early skeletal stabilisation, and subsequent conversion to an intramedullary nail (IMN). We sought to quantify the inflammatory response to initial surgery and conversion and link this to subsequent organ dysfunction and complications.

Patients with femoral shaft fracture, who underwent primary IMN or DCO between 1996 and 2002, with NISS > 20, were identified from our database. Vital signs and blood parameters were collected prospectively every 12 h for 4 days on admission and conversion to allow calculation of the systemic inflammatory response (SIRS) and Marshall multiorgan failure scores (MMOFS). These systems have been previously correlated with outcome and complications in critical care.

One hundred and seventy-four patients met the criteria for inclusion, 77 treated with ETC and 97 with DCO. DCO patients were significantly more severely injured (NISS 36 versus 25, $p < 0.001$). The mean SIRS score was higher at each 12 h point post-operatively in the IMN group, this was significant up to 48 h ($p < 0.05$). The MMOFS was slightly higher at each point in the DCO group; this was only significant at the 48 h point. There was a higher incidence of pneumonia and mortality (significant $p = 0.02$), ARDS and MOF (both n.s.) in the DCO group, this being attributable to the higher incidence of head and thoracic injury (AIS severity 2 or more). The mean peak post-operative SIRS score was significantly higher in the IMN group than in the DCO group, both at primary procedure and conversion, as was the time with SIRS score >1. The pre-op and peak post-op SIRS score correlated with the peak post-op MMOFS score ($p < 0.0002$). The conversion pre-op SIRS score correlated with post-operative peak SIRS score and MMOFS score ($p < 0.0001$). No significant rise in the MMOFS score was observed following the conversion procedure, ex-fix to IMN in the DCO group (Table 3).

It would appear that despite having significantly more severe injuries, patients in the DCO group had a smaller, shorter post-operative systemic inflammatory response and suffered only slightly more pronounced organ failure than the IMN group. The clinical significance of this is unclear. They did suffer more complications, but this was only significant for pneumonia. DCO patients undergoing conversion whilst their SIRS score was raised suffered the most pronounced subsequent inflammatory response and rise in organ failure score.

This data would appear to support the hypothesis that DCO treatment leads to a lesser systemic

inflammatory response than early total care for femur fractures. We were unable to obtain an equivalently injured control group from our database. Larger prospective studies are required for confirmation and to further evaluate consequent multi-organ failure. Patients' inflammatory status should be considered when deciding the timing of conversion to intramedullary device.

Early experience with Linezolid for resistant infections in orthopaedics

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Increasing antibiotic resistance is reported in Gram-positive pathogens, which are commonly implicated in skin, soft tissue, bone and joint infections. In infections, following orthopaedic surgery, isolated staphylococci are reported to be methicillin resistant (MRSA) in up to 50% of cases. Though glycopeptide antibiotics have traditionally been effective in these cases, increasing resistance has been reported and the lack of orally effective preparations has meant long periods of hospitalisation for intravenous therapy. Linezolid, the first in a new class of antibiotics, has excellent efficacy against gram positive organisms that are resistant to other therapies and is 100% orally bioavailable. We report early results of its use for the treatment of resistant infections in orthopaedic practice.

Analysis of all patients treated with Linezolid in our unit was performed. Infections were characterised according to the UK Nosocomial Infections National Surveillance Service classification of surgical infections as superficial, deep or organ/space. We included osteomyelitis, joint sepsis and deep infection involving orthopaedic implants into the final category. Outcome was recorded as clinical, microbiological and blood parameter cure or fail. Over the 12-month study period, 44 patients received Linezolid therapy with, 48% had significant co-morbidity. Infections (80%) were in association with implanted metal-work. There were 6 cases of septic arthritis, 10 of osteomyelitis and 7 infected joint replacements. All but two were treated with vancomycin for a short period before Linezolid was used as oral 'switch' therapy for longer term administration, allowing early discharge in all cases. MRSA was isolated in 80% of the patients treated. The mean length of Linezolid therapy was 40 days (2—151). Cure rates are summarised in Table 1 with clinical success achieved in 86% overall. Table 2 summarises adverse events. Though there were no life-threatening complications, rates were significantly higher than those recorded in the literature, with 18% of patients needing to cease therapy. This may be related to the longer duration of therapy compared with previous trials.

Linezolid offers an excellent alternative to traditional treatments for resistant infections and can facilitate early discharge. Patients need to be monitored closely, particularly where long-term therapy is planned.

Table 1
Treatment and outcome

Infection	*N*	Length Rx	Surgery			Cure rates		
			Wash	Debride	ROMW	Clinical	Inflam.	Micro.
Overall	44	40	34	24	15	38/44	35/42	8/13
Superficial	9	22	3	2	1	9/9	2/2	2/2
Deep	9	40	9	5	0	9/9	7/7	2/3
Organ/deep	26	47	22	17	14	20/26	20/26	4/8

Table 2
Complications compared to overall rates of adverse events from previous studies

Length treatment	Anaemia (%)	↓ WCC (%)	↓ Plt (%)	Mouth ulcers (%)	Skin reaction (%)	Nausea (%)	Vomiting (%)	Diarrhoea (%)	Abnormal LFT (%)	Headache (%)	Other? (%)	Any (%)	Stopped Rx (%)
Overall	11	0	7	5	5	14	18	16	5	9	7	45	18
From lit.	4	1	3	1	1	5	3	6	2	3		23	2

Which AIS based scoring system (ISS, NISS, AISmax) is the best predictor of outcome in patients with blunt trauma

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Abbreviated Injury Scale (AIS) based systems; the Injury Severity Score (ISS), New Injury Severity Score (NISS), and AISmax (worst single AIS score) continue to find widespread application in research and patient care. The merits of each in predicting outcome are controversial. Previous work suggests that this new system may offer improved accuracy in determining outcome. However, a recent publication, based on a large American database, suggests AIS score alone (AISmax) may be superior to the NISS in predicting mortality. Our aim was to investigate this further in a population with predominantly blunt trauma.

A collaborative, multi-centre database, was the source of data for this investigation. All emergency department presentations following acute traumatic injury, requiring intensive care unit admission are included. The predictive capacity of the ISS, NISS and AISmax scores were analysed for outcome, including sepsis, multiple organ failure (MOF), length of stay (LOS), ICU stay and mortality using Receiver Operator Characteristic (ROC) curves.

Patients (13,301) met the inclusion criteria, the mean age was 33.8 years and 77% were male. 95.3% were the victims of blunt trauma. The overall mortality was 15.9% with 11.1% suffering sepsis and 19.3% multi-organ failure (MOF).

All systems were significant outcome predictors for sepsis, MOF, LOS, ICU stay and mortality ($p < 0.0001$). NISS was a significantly better predictor than the ISS for mortality ($p < 0.0001$) and equivalent for other outcomes. NISS was equivalent to AISmax for mortality prediction and on sub-group analysis was markedly superior in patients with blunt and orthopaedic injuries ($p < 0.0001$, data not shown). AISmax was superior in patients with penetrating trauma. NISS was significantly better than the AISmax for prediction of sepsis, MOF, ICU stay and total hospital stay ($p < 0.0001$) in all groups. ROC curve analysis showed that traditional ISS cut-offs should be increased to provide equivalent groups using the NISS (16, 25, 50 to 20, 30, 55).

The NISS was found to be superior or equivalent to the ISS and AISmax for prediction of all investigated outcomes in a population of typical European trauma patients. This was particularly the case for those with blunt trauma and orthopaedic injuries. Our disparity with findings of previous North American studies may be partly due to differences in the distribution of injury mechanisms. As NISS is better and easier to calculate than the ISS, its use is recommended to stratify patients for clinical and research purposes in these patients.

Table 1
Area under ROC curves

Score	Area under ROC curve				
	Sepsis	MOF	Mortality	LOS	ICU stay
ISS	0.660	0.707	0.760*	0.675	0.770
NISS	0.658	0.710	0.773	0.685	0.770
AISmax	0.599*	0.663*	0.775	0.612*	0.703*

* Significant difference between scoring systems in ability to predict that outcome, inferior system marked ($p < 0.0001$).

Surgical delay in acute admissions on warfarin: are we doing enough?

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Warfarin anticoagulation is a common cause of surgical delay, and thus, a concern in any acute surgical admission. We chose to study fracture neck of femur patients on warfarin as they are one of the commonest and any delay in treatment does lead to increased distress and morbidity, and potentially, increased mortality.

Material and methods:

Retrospective analysis: We reviewed 857-fracture neck of femur operations over last 4 years and identified 25 operations, while the patients were on warfarin.

Questionnaire study: This was followed up with a questionnaire study sent to 360 consultant haematologists, designed to assess the current practices and the possible role of Vitamin K in fracture neck of femur patients on warfarin. We received 144 responses.

Results:

The problem

1. The average wait to operation was 4.36 days compared to 1.78 days otherwise.
2. Average time for INR to decrease to <2.0 was 3.44 days.
3. The fall of INR was very unpredictable.

The practice

51% consultant haematologists have responded that Vitamin K reversal is used occasionally, in fracture

neck of femur patients on warfarin, in their institute 34% accept to use Vitamin K reversal often or routinely.
90% and 43% would use Vitamin K reversal in patients with atrial fibrillation and mechanical heart valve, respectively.
80/144 have chosen IV route against 61/144 for oral. Rewarfaranisation and anaphylaxis are prime concerns for 49% and 29% haematologists, respectively.

Conclusion: Warfarin anticoagulation can cause significant delay in acute surgical admissions. Guidelines are required for Vitamin K reversal in semi-urgent situations. Further studies are needed for effective route and dose required. Effect of Vitamin K on rewarfaranisation has yet to be validated. We propose a protocol for a multicentric trial to evaluate efficacy of Vitamin K reversal.

Biomechanical evaluation of FiberWire as a tension band in olecranon fracture fixation

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Introduction: Tension band wiring is a common technique for olecranon fracture fixation. The most commonly used material for the tension band is stainless steel wire. There are, however, potential problems associated with stainless steel wire. Ethibond has previously been cited as a suitable alternative material but not FiberWire. The biomechanical properties of FiberWire as a tension band material have not been evaluated. This study aimed to investigate the properties of FiberWire and compare them with stainless steel wire and Ethibond.

Methods: Saw-bone olecranons were osteotomised identically to create an olecranon fracture. Tension band constructs were produced using stainless steel wire, Ethibond and FiberWire. The construct was tested by cyclical loading with an ESH dynamic testing machine. A preload of 5 N was applied before cyclical loading at levels up to 200 N. The fracture gap was measured with a displacement transducer.

Results: At loading up to 100 N, the stainless steel wire allowed an average fracture gap of 200 μm. Five gauge Ethibond allowed a larger fracture gap of 350 μm ($p < 0.05$). Two gauge FiberWire did not allow a significantly different fracture gap to Ethibond.

Discussion: The fracture gap with suture material was greater than with stainless steel wire, but still less then 0.5 mm with loading of 100 N. In a 70 kg man, this would correspond to the forces expected in extending the elbow against gravity. This means that these alternative materials are mechanically suitable for use in clinical practice for tension bands. This can avoid some of the complications of stainless steel wire.

Conclusion: Ethibond (5 gauge) and FiberWire (2 gauge) are biomechanically suitable as alternatives to stainless steel wire in tension band wire fixation of olecranon fractures.

A year of trauma registry in a busy urban teaching hospital

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The trauma registry in this busy urban teaching hospital was initiated in April 2003. Adult trauma calls have been entered prospectively since that time. Details of patient demographics, mechanism of injury, brief description of injury, and outcome are logged by the trauma nurse coordinator onto a spreadsheet.

From April 2003 to April 2004, there were 560 adult trauma calls. Eighty-three percent were male and 80% were blunt injuries. The overall mortality rate was 8%.

We present the different mechanisms of injury, times of presentation, age of patients, and the mortality rates associated with age and time of presentation. More patients died when they presented during daytime hours, than during the evening or night.

We also present the modes of arrival to the hospital, whether by land ambulance or by helicopter, and their associated mortality rates. Trauma patients also present to our hospital from all regions of the city, and only the minority are from our health authority.

The findings from the registry will have important implications in the future funding of trauma patients who are from out of region. The higher mortality rates found during the day may be explained by a number of factors, including differences in injury severity.

Re-evaluation of low molecular weight heparin in the thromboprophylaxis of pelvic and acetabular trauma surgery

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Introduction: Since July 1997, all pelvic and acetabular trauma patients have been managed with low molecular weight heparin after previous work showed a decreased incidence of proximal deep vein thrombosis (DVT) with the use LMWH within 24 h of injury ($p < 0.01$). Injuries three or more days old are screened with a pre-operative venous doppler and patients are routinely screened 7—10 days post-operatively for lower limb deep vein thrombosis.

Method: All pelvic and acetabular fractures from August 1997 to August 2003, admitted to our hospital were analysed for compliance with the use of LMWH, outcomes of pre-operative and post-operative venous doppler tests and thrombo-embolic events were recorded.

Results: One hundred and eighty-nine patients were admitted between August 1997 and August 2003 (146 males and 43 females). Ninety-eight patients sustained pelvic trauma, 79 acetabular and 22 combined pelvic and acetabular injuries. Thirteen patients were managed conservatively. One hundred and five patients received a LMWH within the first 24 h, 93 patients a pre-operative venous doppler and 152 patients a post-operative venous doppler. The overall incidence of proximal deep vein thrombosis was 6.9% and pulmonary embolism was 1.6%. Three patients had an inferior vena caval (IVC) filter inserted pre-operatively after a proximal DVT was identified. Two filters were blocked by thrombus and left in situ. No patients died of a pulmonary embolus. Proximal DVT developed in four of 105 patients (3.8%) receiving a LMWH within 24 h, but in nine of 84 patients (10.7%) receiving LMWH later than 24 h post-injury.

Conclusion: We conclude that LMWH if commenced within 24 h of injury is a safe and effective method of thrombo-prophylaxis in patients with major pelvic or acetabular fractures. The use of IVC filters has also allowed three patients to undergo successful reconstructive surgery of major pelvic injuries safely.

Retrograde femoral nail for distal femoral fractures

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Introduction: Distal femoral shaft and supracondylar fractures are now more common. Non-operative treatment of these challenging fractures is difficult and fraught with complications. Retrograde and supracondylar nails have emerged as a good alternative to stabilise these fractures. This study evaluates the outcome of retrograde femoral nails done over a span of 5 years at a University Hospital.

Materials and methods: In this retrospective study, review of case notes and radiographs of 56 patients was done. All patients, who underwent retrograde and supracondylar femoral nailing between 1999 and 2003, were included. Various factors, including patient demographics, mechanism of injury and fracture type were studied. Time to union, intra and post-operative complications and need for re-operation were also recorded.

Results: Forty-one retrograde and 15 supracondylar femoral nails were done in the study period. There were 16 males and 40 females. Most of the patients had sustained their fractures due to fall. Three out of the fifty-six patients presented with open fractures. Fifty-three patients had insertion of reamed nails and 52 of them had both ends locked. The average time of operation was 2 h and 10 min and the average blood loss was 500 ml. Most patients were mobilised early with partial weight bearing.

There were three superficial wound infections, which resolved with appropriate antibiotics. There were no cases of nerve damage or septic arthritis. Two patients died with bronchopneumonia in the post-operative period.

Fifty-five out of fifty-six fractures united at an average of 9 weeks. One patient required re-operation for non-union, 9 months after the index operation.

Conclusion: We conclude from this study that there is a high union rate of distal femoral fractures treated with supracondylar and retrograde nails with very low complication rate. It allows early mobilisation, particularly in elderly patients and seems to produce very good functional outcome with low re-operation rate.

Intramedullary nailing of humeral diaphyseal fractures

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Introduction: The surgical treatment of fractures of the humeral shaft remains controversial. The two most common operative methods used are plate osteosynthesis and intramedullary nailing.

Aims: This study aims to show the reliability and success of intramedullary nailing for humeral shaft fractures.

Methods: We performed a retrospective review of all patients who underwent intramedullary nail-

ing of humeral fractures over a 10-year period. Patients were followed up and assessed clinically and radiologically. Outcome measures included radiological union and shoulder function in terms of pain and range of motion. Indications for intramedullary nailing included displaced humeral shaft fractures ($n = 70$), failure of conservative treatment ($n = 26$) and pathological fractures ($n = 19$).

Results: One hundred and fifteen intramedullary humeral nails were performed. There were 51 males and 64 females. The average age of the patients was 61 ± 20 years (range 17—90). The average follow up of the study cohort was 8 ± 6.5 months (range 1—28). The average time to radiological union was 12 ± 3 weeks (range 8—38), with 86% treated fractures uniting within 4 months. Two patients with pathological fractures died prior to union and a further 14 patients were lost to follow up. Of the 99 patients who presented for follow up, five developed a non-union and nine developed delayed union (defined as failure of fracture to unite within 4 months). Six IM nails were removed, five for non-union and one for proximal migration of the nail. Five revisions were performed for non-union consisting of one exchange nail and four open reduction and internal fixations. Only one patient required a manipulation under anaesthesia for poor shoulder function.

Conclusion: The union rate in this series of 86% at 4 months suggests that intramedullary nailing should be considered as primary treatment for humeral shaft fractures. In particular, it has a major role in the management of pathological fractures and polytrauma where the advantages of lower morbidity and smaller dissection of soft tissues than other operative techniques are paramount.

Displaced intracapsular hip fractures in the alcohol-abusing patient

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Aim: Alcohol-abuse is a well-recognised problem in the West of Scotland. This study aims to assess the presentation, management and early outcome of alcohol-abusing patients sustaining displaced intracapsular fractures compared to age-matched controls.

Methods: Patients were identified from a prospectively collected database of trauma admissions from 1998 to 2002. Alcohol-abuse was defined by documented evidence of excessive and chronic alcohol intake.

Results: Thirty-five alcohol-abusing patients under the age of 65 (mean age 57.5 years) with displaced intracapsular fractures were identified and followed-up for a mean of 3.87 years, and compared with 39 age-matched controls (mean follow-up 3.35 years).

There were marked differences in delays to presentation, theatre and post-operative duration. Alcohol-abusers presented at a median of 9.67 h after injury, compared to 2.97 h for the control group. Sixty-five percent underwent surgery within 24 h of admission, compared with 79% of non-abusers. Median inpatient stay was 11.2 days (7.0 days for controls). Twenty-six percent of abusers required increased level of care after discharge compared with 15% of non-abusers.

Reduction and fixation was employed in 26 alcohol-abusing patients and 30 controls. Early post-operative complications were similar in both groups with the exception of delirium tremens (17% of abusers). Of patients treated with internal fixation, four patients in the alcohol-abuse group required revision surgery (15%) compared to three of the control group (10%, no significant difference). Two patients within the abusers group developed avascular necrosis (7.7%) compared to three within the control population (10%, no significant difference); only two of these five required revision surgery with femoral head replacement.

Conclusions: Alcohol-abusing patients with displaced intracapsular fractures have an increased economic burden compared to controls, requiring longer inpatient stays and increased levels of care on discharge. However, this study finds no evidence that they are at greater risk of failure of internal fixation as compared to controls.

The Impact of Injuries below the knee joint on the long-term functional outcome following polytrauma

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Previous studies have suggested that the lower extremities are among the most frequently injured body regions in polytrauma patients and have a major impact on the functional recovery following polytrauma. In particular, injuries to the distal part

of the lower extremity appear to be associated with a poor functional outcome. Therefore, the goal of this study was to evaluate the impact of injuries below the knee joint on the long-term functional outcome following polytrauma. Three hundred eighty-nine polytrauma patients with associated lower extremity fractures and a minimum follow-up of 10 years were included in this study. All patients were examined by a doctor, using a patient questionnaire and a standardised physical examination. The average follow-up was 18 (range 10—28) years. Significantly inferior outcomes were seen in patients with fractures below the knee joint as measured by the modified Karlström-Olerud Score, Lysholm Score, range of motion, weight bearing status, Hannover Score for Polytrauma Outcome, SF-12, Tegner Activity Score, and inability to work ($p < 0.05$). Fractures below the knee joint have a significant impact on the functional recovery following polytrauma. We suggest that delayed treatment, thin soft tissue envelope below the knee joint, high-energy trauma, unfavorable blood supply, and complex fracture patterns contribute to these unfavorable outcomes.

Functional recovery 18 years after polytrauma: a comparison between workers' compensation and non-workers' compensation patients

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Background: Previous studies have shown that work-related injuries are often associated with inferior outcomes. Most of these studies, however, have focused on single injuries and relatively short follow-up periods. It is uncertain whether these results can be extrapolated to long-term outcomes following polytrauma. Therefore, the aim of this study was to evaluate the long-term functional recovery following polytrauma, using a minimum follow-up of 10 years, and to compare the outcomes between work-related and non-work-related injuries.

Methods: Six hundred thirty-seven polytrauma patients were evaluated on an outpatient basis by a trauma surgeon using a self-administered patient questionnaire and a standardised physical exam. The average follow-up was 17.5 (range 10—28) years; the average Injury Severity Score was 20.7 (range 4—54). Main outcome measurements included the Hannover Score for Polytrauma Outcome (HASPOC), the 12-Item Short-Form Health Survey (SF-12), requirement for medical aids and devices, physical disability, return to work, length of rehabilitation, and the subjective satisfaction with the rehabilitation status.

Results: A multivariate analysis, with adjustments for age, gender, injury severity, and injury pattern, demonstrated that work-related injuries resulted in significantly inferior outcomes as measured by HASPOC, SF-12, requirement for medical aids and devices, length of rehabilitation, and return to work ($p < 0.05$).

Conclusions: Polytrauma patients receiving workers' compensation achieve significantly inferior subjective and objective long-term outcomes than other patients. The obtained results demonstrate that psychosocial variables, such as insurance status have a significant impact on the functional recovery following polytrauma. We suggest that psychosocial support may further improve outcomes in these patients.

Accelerated bone healing in patients with femoral fracture and head injury

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The combination of head injury and femoral shaft fracture in polytrauma patients is relatively common. The effect of head injury on systemic physiology, including bone healing is still a topic of vivid discussion. We investigated healing rates for femoral shaft fractures in the presence of head injury.

Data on randomly selected patients with diaphyseal femoral fracture from our trauma database was collected and analysed. Patients with factors that could influence bone healing, such as smoking or the use of non-steroidal anti-inflammatories were excluded. Patient groups were formed by the presence or absence of head injury, and the reamed or unreamed nailing technique used. Time to bony union was assessed from serial X-rays and clinical examination. The severity of head injury was quantified using AIS severity score. All patients were followed to discharge and through outpatients' appointments until bony union. Time to union was defined as the presence of circumferential callus in two planes and the presence of full painless weight bearing, which-

Table 1
Clinical data divided by presence of head injury and nail reaming

Variable	Head injured	Without head injury reamed nail	Without head injury unreamed nail
Number	17	25	24
Age (mean)	29.4 years (14—53)	32 years (16—81)	47 years (17—83)
Sex (m)	14 m, 3 f	19 m, 6 f	18 m, 6 f
Fracture	5 open, 15 closed	2 open, 23 closed	2 open, 22 closed
Treatment	17 IMN (6 reamed)	Reamed IMN	Unreamed IMN
Head injury	Mean AIS—3.4 (2—5)	No	No
Mean time to union	10.5 weeks (6—22)	20.5 weeks (14—32)	26.9 weeks (21—32)

ever was the longer. The mean time of follow up was 12.1 months (9—18).

In total, 66 patients were studied. Overall, demographic details between the head injury and non-head injury group revealed no significant differences with regard to the ISS, sex, age or incidence of open fracture (Table 1). However, separation of patients into reamed and unreamed groups showed a significant difference of age between the head injured patients and the group subjected to unreamed femoral nailing. There was no overall difference in the distribution of fracture classification amongst the groups studied. Overall, the mean time to union was 22.9 weeks in patients without head injury versus 10.5 weeks in those with head injury ($p < 0.0001$). Separation of patients by the presence or absence of the reamed technique did not alter this.

It would appear that patients with head injury undergo much more rapid fracture healing when compared to those without. An increased understanding of the pathways and mechanisms involved in fracture healing following traumatic brain injury, in particular, a greater understanding of mesenchymal stem cells and their control pathways, could allow further development of their potential therapeutic uses.

Health related quality of life in trauma patients following the full spectrum of tibial injury (fasciotomy, closed fracture, open fracture and amputation)

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Whilst isolated reports on quality of life in trauma patients following tibial trauma are available, no studies exist analysing this measurement of outcome in the full spectrum of injury, from isolated compartment syndrome to severe injuries leading to amputation. In this study, we aimed to quantify the health related quality of life in a series of patients suffering a variety of different tibial injuries.

Patients with previous tibial injury, randomly selected from our trauma database, completing treatment at our institution, were recalled for final assessment. The EQ-5D (EuroQol) Questionnaire, a validated, measure of health related quality of life was used to assess functional outcome. This scores patients' perceived funciton from 0 to 100% (100% being best) based on five dimensions, anxiety/depression, pain/discomfort, usual activity, self-care and mobility and a visual analogue score (VAS) to assess overall levels of function.

One hundred and thirty patients were evaluated, the mean time to final follow up was 37.4 months. Demographics along with results of the VAS are summarised in Table 1, EuroQol results in the chart. There was no significant difference in self-care between the groups. Psychological problems were common in patients with IIIb and IIIc fractures, as well as amputees with the highest incidence in those with IIIc fractures. Patients who had undergone amputation and those with IIIb open fractures reported problems with mobility significantly more frequently than those who had IIIc type injuries; this could be partially attributed to the significant difference in mean age between groups. Patients with IIIb and IIIc fractures reported significantly more pain compared with those amputees. Interestingly, patients who had undergone fasciotomy reported pain as frequently as amputees. Regarding the VAS, only patients with closed # reported significantly different scores from the mean of all the other groups. This data represents the health related quality of life of patients having suffered the full spectrum of tibial injury and should be considered when determining the treatment options for these patients.

Table 1
Patient demographics and results of VAS

Group	Amputees	Grade IIIb	Grade IIIc	Closed #	Fasciotomies
N	22	30	15	30	33
Age (mean)	46.8*	46.9*	31.9*	39.5	32.9
Sex (m)	17	23	12	23	29
Mean ISS	13.5	11.6	11.7	9.8	5.1
Mean VAS (%)	66	68	63	77*	67

* $p < 0.05$.

Patterns of DHS failure—a classification

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Background: Dynamic hip screw (DHS) fixation is commonly performed. It has a small but significant failure rate. There have been studies on reasons of failure but a literature search did not find any classification of the patterns of DHS failure. Hence, we preformed an evaluation of failed DHS fixation and have developed a classification system with relevance to management.

Methods: Retrospective study of case notes and radiographs of patients who required revision following DHS fixation between April 1996 and August 2003. Patients identified through Theatre Database. Data was collected on the mode of failure, method of revision, complications following revision and the period of follow-up. We excluded patients whose notes and radiographs could not be obtained.

Results: One thousand eighty-six DHS were performed between 1996 and 2003. Thirty-eight required a revision. Notes of five patients could not be traced so 33 patients were analysed. The patterns of failure could be classified as follows:

Type	Description
I	Screw cut out from head of femur (a) Minimal cut out with no significant acetabular damage (b) Complete cut out with significant acetabular damage
II	Cortical screw pull out from shaft (a) Fracture united (b) Fracture not united
III	Failure of implant (breakage) (a) Fracture united (b) Fracture not united

Conclusion: The proposed classification system was found to be all inclusive and mutually exclusive. We propose some suggestions for managing the patient with a failed DHS.

(Ia) Hemiarthroplasty
(Ib) Total hip replacement
(IIa) Implant removal
(IIb) Long plate fixation and bone grafting/IM nail
(IIIa) Implant removal
(IIIb) Arthroplasty/refixation and bone grafting

Incidence of peri-prosthetic fractures in cemented as compared to un-cemented hip hemiarthroplasty

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Purpose: There is variation between, and within hospitals in the use of different designs of hip hemiarthroplasty. There has been anecdotal evidence of a high rate of peri-prosthetic fractures in un-cemented hemiarthroplasties. The incidence of these fractures in all designs used at this hospital was investigated and a comparison made between the cemented and un-cemented groups.

Methods: The hospital notes of all patients who received a hemiarthroplasty in the first 4 months of 2002 were reviewed. Patient demographics, mental and physical state were recorded in the form of age, abbreviated mental test score (AMTS), and American Society of Anaesthesiologists (ASA) score. The two groups were shown to be equivalent for these parameters.

Results: Of the 67 patients in this group 45 received a cemented hemiarthroplasty and 22 received an un-cemented hemiarthroplasty. Of the un-cemented group, four (18%) patients sustained a subsequent peri-prosthetic fracture compared to none in the cemented group. Three of

these were fractures of the greater trochanter, treated conservatively, whilst the fourth was a fracture of the calcar associated with dislocation, requiring open reduction and circlage wire repair.

Conclusion: These results suggest a significantly higher rate of peri-prosthetic fracture in uncemented compared to cemented hip hemiarthroplasty.

Revision of failed DHS—analysis of results

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Background: DHS is the gold standard for intertrochanteric fractures. It has a small but significant failure rate. There are papers on outcome and reasons for failure but no clear guidelines for management.

Methods: Retrospective study of patients requiring revision surgery following a DHS between April 1996 and August 2003. Data collected on the fracture type, co-morbidities, mode of failure, method of revision and complications. The median follow-up period was 12 months (IQR, 12—24 months). Mean = 21 months, S.D. ± 23.

Results: One thousand eighty-six DHS performed between 1996 and 2003: 38 required revision; 32 analysed; mean age at initial surgery 73 years (S.D. ±17); median 75 years. At revision, mean 76 years; median 79 years (S.D. ±16); females 29. Seventy-two percent had co-morbidity, analysis based on age did not have statistical significance (Wilcoxon rank-sum (Mann—Whitney) test, $p = 0.14$). Registrars performed 81% of revisions. No statistical significance in complications by the surgeon grade, $p = 0.6$ (Fisher's exact test).

Mode of failure

Screw cut out	44%
Peri-implant fracture	28%
Hip pain	28%

This was statistically significant in the development of complications, $p = 0.02$.

Mean interval between primary procedure and revision was 28.5 months.

The type of revision procedure (arthroplasty 41%, refixation 34%, removal of metalwork 25%) was significant in the outcome, $p = 0.03$. Complications in the groups were: arthroplasty, two; refixation, seven and removal of metalwork, one.

Conclusions: Multivariate analysis shows that procedure type and mode of failure are statistically significant in development of complications but becomes insignificant after adjusting for age, surgeon grade and co-morbidity.

From our study we feel that arthroplasty is a better procedure for managing patients with a failed DHS. Prospective randomised controlled trials are required to determine the best procedure for different modes of failure of a DHS.

Assessment of a fracture outpatient rapid review process

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Background: Our hospital operates a consultant rapid review process of X-rays and notes of patients referred to fracture clinic from A&E and GPs. This compares with other centres where patients are reviewed in outpatient clinics soon after injury.

Aim: Evaluate effectiveness of consultant led rapid review process compared to standard consultant fracture clinics.

Patients and methods: Prospective study of rapid review process over 4 weeks of all patients referred to fracture clinic by A&E and GPs. Total number of patients referred per day, time taken to review these patients notes and X-rays, number of recalls and reason for recall were documented. This was compared to a previous audit of consultant led fracture clinics, which included times taken to review patients.

Results: Seven hundred eighty-seven patients were processed through rapid review over 4 weeks, 6% were recalled, 4% for a change of management which represents a success of the system and 2% because of lack of information which represents a failure of the system. The mean number of patients referred per day was 28 taking a mean of 25 min; the mean time to see one patient was thus 0.9 min (0.4—1.7 min). The mean time taken to review a patient in a standard fracture clinic was 7.3 min (5.3—105 min). The time taken to review the mean 1.7 recalls can thus be estimated as 12 min. The total time taken to review 28 patients in the standard fracture clinic would be 204 min. Using the rapid review process the same 28 patients could be processed in 37 min.

Discussion: A consultant led rapid review process of all patients referred to fracture clinic is a very efficient process. Rapid review process saves clinic time and resources, minimises delays in clinical decision-making and saves the

patient an unnecessary visit to the Outpatient Department.

The use of the Stoppa approach in the operative treatment of pelvic and acetabular trauma

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The Stoppa approach was originally conceived to deal with difficult abdominal hernia surgery. Its use has been modified to deal with acetabular and pelvic surgery. We report on our use of the Stoppa approach in 26 cases from 1998 to 2003 to fix pelvic, acetabular, and combined pelvic/acetabular fractures.

The Stoppa approach was used in combination with other approaches to afford the best access for fixation. Eleven of the cases were acetabular fractures with no pelvic ring disruption (42.3%), four cases (15.3%) were pelvic ring disruptions without an acetabular component. The other 11 cases (42.3%) were combined pelvic and acetabular fractures where this approach came into its own. In particular it is to be noted that the corona mortis was easily identifiable in five (19.2%) of the cases to allow its safe ligation.

The anatomy of the approach and the access afforded are considered, along with the plating techniques that can be achieved because of its use.

Patients were followed up for an average of 17.39 months with one lost to follow-up. Clinical results were excellent in 20 cases, good in 2, fair in 2, and poor in 1.

Complications were lateral femoral cutaneous nerve palsy in 11 patients, one bladder rupture, two superficial wound infections, one lateral incisional hernia related to an ilioinguinal approach, and one deep vein thrombosis. Heterotopic ossification occurred in three patients in whom the Kocher-Langenbeck approach was used. One revision for screw proximity to the joint was undertaken.

The Stoppa approach allows safe access and ease of reduction and fixation in these complex fractures, in combination with other approaches, particularly in combined pelvic and acetabular fractures. We outline our recommendations for its use in this paper and outline a series of fracture patterns where it is most helpful.

The value of the fracture type in predicting immediate loss of stabilisation of intertrochanteric fractures of the hip

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Purpose: The optimal implant for the fixation of intertrochanteric femoral neck fractures is still debatable. Dynamic hip screw (DHS) remains the gold standard device in our clinical practice. Nonetheless, the rate of mechanical failure of DHS has been reported to be as high as 30%. It has been suggested that accurate reduction of the fracture is essential to achieve best fixation, and thus outcome. Many attempts have been made to identify and quantify the variables that affect the failure of DHS fixation. The age of the patient, the pattern of the fracture, the stability of the reduction, and the position of the lag screw within the femoral head have all been related to the incidence of failure. However, there is limited evidence in the literature regarding the relative importance of each of these factors to the risk of immediate loss of stabilisation. We therefore investigated the significance of various demographic, geometric, and technical parameters in relation to the immediate loss of reduction of intertrochanteric femoral neck fractures.

Methods and patients: The intra-operative fluoroscopy and immediate post-mobilisation plain radiograph pictures of 100, randomly selected patients, who underwent DHS fixation for intertrochanteric fracture neck of femur, were evaluated and compared for the quality of reduction. Parameters of investigation included: demographic variables (age, gender); type of fracture (classified according to the system of Evans); quality of the reduction (according to the system of Sernbo et al.); position of the hip screw (according to the zones described by Kyle et al.); the distance of the tip of the hip screw from the apex of the femoral head (Tip Apex Distance [TAD]), use of additional de-rotational screw; and type of the implant (angle and the number of holes of the side plate). Statistical analysis, at 5% significance level, using a logistic regression model was conducted.

Results: The cohort contains 78 female and 22 male patients. The mean age of the women at the time of surgery was 75 years (54—100 years) and that for the men was 70 years (50—93 years). The stable fractures accounted for 35 of the cases and the unstable fractures for the remaining 65. The treatment of 52 of the 100 fractures showed radiological signs of immediate, post-operative loss of reduction (Sernbo et al.) and therefore stabilisation of DHS fixation. Out of the 52-failed fixations, 45 were unstable and six were stable fractures (λ^2-test, $p = 0.003$). Bivariate and multivariate logistic

regression analysis revealed that the fracture pattern ''unstable'' is considered to be the strongest predictor for the immediate loss of reduction ($p = 0.02$). The use of an additional de-rotational screw was a strong negative predictor for the failure of fixation ($p = 0.04$). The age and the gender of the patients, the side of the fracture, the neck-shaft angle, the position of the screw, the TAD, and the type of the implant did not significantly correlate to the risk of failure (all with $p > 0.5$).

Conclusion: Our results demonstrate that the rate of radiological failure of DHS fixation for intertrochanteric femoral neck fractures is higher than previously reported. An unstable fracture pattern is the paramount cause for failure. This finding has added further evidence against the usage of DHS implant for the fixation of unstable fractures and we recommend that alternative methods of fixation be considered for these fractures patterns. This suggests that the choice of the implant can influence mechanical stability of femoral neck fixation and thus outcome. This needs to be emphasised, particularly during training, in the hope of improving overall results in the future.

Is C-arm the imaging technique of choice for the fixation of femoral neck fractures?

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Purpose: Fracture of the femoral neck is a commonly encountered problem, especially in the elderly patients, in our clinical practice. For a successful fixation, and thus outcome, of femoral neck fractures it has been suggested that accurate reduction of the fracture and optimal placement of the implant are essential. Previous studies in this field have used immediate post-operative plain radiographs to determine the quality of stabilisation. C-arm (fluoroscopy) is a widely used imaging technique for the fixation of femoral neck fractures. Therefore, it is imperative that this apparatus be reliable. Our aim, therefore, was to assess the inter-observer reliability of the C-arm images for the precision of fractures' reduction and the position of the implant in the current practice.

Methods and patients: This is an observational, cohort, clinical study. The standard fluoroscopy pictures (FP) of 50, randomly selected patients, who underwent dynamic hip screw (DHS) fixation for peritrochanteric femoral neck fractures, were evaluated independently by four trauma surgeons of different levels of experience. Parameters of investigation included: type and the stability of the fracture; neck-shaft angle; quality of the reduction of the fracture (displacement and alignment), position of the hip screw (according to the zones described by Kyle et al.); and the distance of the tip of the hip screw from the apex of the femoral head (Tip Apex Distance [TAD], the sum of the distances from the tip of the hip screw to the apex of the femoral head on an anterior—posterior and lateral radiographs after controlling for magnification). Inter-observer reliability was assessed by comparison of these variables determined by the four observers. All fractures were classified according to Orthopedic Trauma Association (OTA) Classification System. All pictures evaluated were in two planes at 90° to each other (anterior—posterior and lateral) and of good quality. Statistical analysis, using computer generated kappa (κ) reliability coefficients was performed.

Results: The most significant results of the study were: (I) the four observers obtained good agreement for neck-shaft angle and the type of the fracture readings ($\kappa = 0.67$ and 0.80, respectively). (II) There was significant disagreement (fair to poor) between all four observers in for the following criteria: quality of the reduction ($\kappa = 0.36$), position the hip screw ($\kappa = 0.38$), and the distance of the tip of the hip screw from the apex of the femoral head ($\kappa = 0.18$).

Conclusion: This is the first study to assess the reliability of the C-arm films for the recognition of the quality of stabilisation for fracture neck of femur. Our results shows that fluoroscopy is not reliable and we recommend that alternative imaging techniques should be considered. This is important from medico-legal stance point of view, as surgeons have been criticised for not achieving adequate results in negligent cases.

Biochemical modulation following spinal, pelvic and acetabular and lower extremity skeletal surgery: prospective, cohort study to quantify the burden of surgery

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Purpose: Pro-inflammatory cytokines can be used as markers to monitor the development of variety of adverse outcomes in polytrauma patients. An association of these parameters with the risk of development of multiple organ failure in multiple injured patients has been described. In this study, in clinically stable patients with an isolated trunkal and

lower extremity fractures, the effects induced by different types of primary fracture stabilisation on the systemic release of proinflammatory cytokines were evaluated.

Patients and methods: This is a clinical, multicentre, prospective, cohort study. Inclusion criteria were blunt trauma; age 16—75 years; stable clinical condition; and thoracic abbreviated injury scale (AIS) score < 4. Groups included were as follows: group MIFF ''control—17 patients'' (primary intramedullary nailing as part of multiple surgical procedures in multiple injured patients with femoral shaft fractures), injury severity score 16 or more than three extremities injuries (AIS score of 2 or more) in association with another injury (AIS score of 2 or more); group IPAF ''14 patients'' (open reduction and internal fixation [ORIF] for isolated pelvic and acetabular fractures); group ISF ''22 patients'' (ORIF for isolated spinal fractures); and group IFF ''28 patients'' (primary intramedullary nailing for isolated femoral shaft fractures). Variables of proinflammatory cytokines: interleukines (IL-6, IL-8), obtained via serially sampled central venous blood and quantified using a commercial solid phase ELISA. The mean time of surgery for pelvic and acetabular fractures was 181 min (92—370 min), for spinal trauma was 147 min (83—240 min), and that for isolated femoral fracture fixation was 62 min (42—86 min). Statistical analysis, using two-way ANOVA and post-hoc tests was performed.

Results: There was a significant difference in the severity of injuries [ISS] between polytrauma patients with early total care (ETC) and isolated fractures. ORIF for isolated pelvic and acetabulum, spine, and femoral shaft fractures caused comparable increases in perioperative cytokine concentrations with polytrauma cases. The highest concentrations of pro-inflammatory cytokines were evident in sacral fractures, bi-segmental spinal injuries, posterior pelvic approach, and ventral spinal approach. The peak concentration of IL-6 occurred at 24 h postoperatively. Comparable results were found for IL-8.

Conclusion: Trunkal and lower extremity skeletal surgery inflicts an additional burden to the already traumatised patients and causes significant changes to the biomechanical markers. These parameters may be of value to monitor the condition of the patient before clinical complications emerge. In polytrauma patients, a tendency towards greater increase of these markers in comparison with isolated fractures was observed. This data appear to support the concept of a Damage Control Orthopedic approach for multiple injured patients who are at high risk of developing complications.

Pathogenesis of injury—the relationship between perception of time and risk of injury

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Introduction: The human body has extensive mechanisms both to avoid injury and to minimise its effects. These defensive mechanisms are carried out either as reflex arc actions or are under higher control, the latter is particularly important in injuries as a result of simple falls or sporting activities.

What therefore, determines an individual's ability to protect themselves? Does injury result from a failure these mechanisms?

The author sought to answer this problem by investigating the influence of an individual's perception of time with the ability to avoid injury.

Method: Forty volunteer subjects were asked to participate in the study. Each test was repeated on five occasions for each volunteer on differing times of the day. The perception of time was measured by isolating the individual in a senseless environment (no sound/vision) and the actual time of a perceived minute was recorded. A simple visual reaction test was also performed and recorded.

To determine the relationship between the body's reaction to potential injury and the perception of time, baseline measurements were taken from 10 volunteers. The passage of each perceived second was recorded with a RF transmitter whilst the subjects were on a rollercoaster ride. This recorded an instantaneous measure of the perceived passage of time.

Results: The results show that there is wide variation between individuals upon the perception of time. There is an age related acceleration of the perception of time, which directly correlates to the deterioration of visual reaction time.

The second experiment indicates that the human body slows down the perception of time in response to potential injury. The result of which is an increase in the reaction time hence reducing the likelihood that injury occurs.

Conclusion: The hypothesis of this study is that certain individuals are predisposed toward injury. Injury occurs from a failure of normal mechanisms of protection dictated by the perceived passage of time.

Functional outcome following distal radial fractures

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Introduction: Two hundred fifty-five patients attended A&E of our hospital with distal radial fractures from November 2001 to August 2002. From the data, we compared the functional outcome between MUA and MUA with K-wiring.

Patients and methods: There were 93 patients selected for the study, eight lost to follow-up, therefore functional outcome of 85 patients was evaluated.

Fifty-three patients treated with MUA only (10 under GA) and 40 patients with MUA and K-wiring (two crossed wires). No difference in the age and sex distribution between the two groups. Fifty percent of the MUA and 40% of the K-wire group sustained 23A2 fractures while 25% of K-wire group sustained 23C2 fractures. Patients were followed for 6 months. A visual analogue 10 cm pain score was used to assess the patient's satisfaction.

Results: One pin site infection with K-wire, treated with antibiotics. Two patients with K-wire had their fracture re-displaced and required re-visit to the theatre for the adjustment of the K-wires. Eight patients required K-wiring because of failed conservative treatment out of which six had MUA under LA and two under GA.

One patient in the conservative group complained of pain in the radial joint, undiagnosed scaphoid fracture was found that has been referred to bone grafting.

The average loss of grip strength in MUA and K-wire was 10 and 9 kg, respectively. The average loss of palmer and dorsi flexion in MUA was 15 and 12 and 20 and 10 in the K-wire group. The average pain score was 3 in both groups.

Conclusion: The overall outcome was not statistically significant between the two groups in the elderly population. Therefore, although X-ray does demonstrate collapse, K-wiring is often not indicated in the elderly population, as there is no difference in the functional outcome. Whereas, aggressive treatment is required in the younger population to achieve anatomical reduction.

Total hip arthroplasty: bacterial contaminants and their sensitivity to currently in use prophylactic antibiotics

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Aim: To investigate and identify the contaminating bacteria in hip arthroplasty and their sensitivity to currently in use prophylactic antibiotics.

Material and method: During fifty total hip replacement procedures, impressions of gloved hands of the principal surgeon, first assistant and the scrubbed nurse were obtained on blood agar, immediately before the gloves were discarded. Culture plates were incubated at 37 °C for 48 h. All isolates were identified by gram stain and basic identification tests. All bacterial isolates were then, tested for sensitivity for flucloxacillin which is a recognised indicator of sensitivity to cefuroxime. We also tested organism against gentamicin, fucidin and linezolid.

Results: Impressions of 627 pairs of gloved hands were included in the study, of which 57 (9.13%) impressions were found contaminated. There were 106 bacterial isolates.

Coagulase-negative staphylococci (CNS) were isolated more frequently, 68.8%, followed by micrococcus 12.2% and diphtheroids at 9.4%. *Staphylococcus aureus* represented 6.6% of the total number of isolates ($n = 7/106$). There were two isolates of pseudomonas and one *E. coli*.

73/106 isolates (only 52%) of the CNS were found to be sensitive to flucloxacillin and therefore by inference to cefuroxime. Eighty-nine percent of isolates were sensitive to fusidic acid and 95.9% to gentamicin. All Gram-positive isolates were sensitive to linozolid.

Discussion and conclusion: This study suggests that we should question whether cefuroxime is the most effective agent for antibiotic prophylaxis. In our study Staphylococci represent 75% of contaminating isolates; nearly half of them were resistant to cefuroxime, which is the main agent used for antibiotic prophylaxis in current orthopaedic practice in the UK.

From these findings and by reviewing the available evidence in literature, we believe that the time has come to review the appropriateness of cefuroxime prophylaxis and consider other agents and do the necessary studies to establish the best agents.

Paediatric supracondylar humeral fractures: 10 years experience in a tertiary referral centre

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Introduction: Supracondylar humeral fractures are the most common injuries around the elbow joint in children. There is lack of consensus regarding the timing of surgery, approach for open reduction and positioning of K-wires for treatment of this common paediatric fracture. We report our experience over a period of 10 years in a tertiary referral centre.

Materials and methods: A retrospective review of notes and radiographs of all children who presented with a documented supracondylar humeral fracture was conducted. A total of 268 patients with complete documentation from January 1993 to January 2003 were identified.

Results: There were 178 boys and 90 girls. Most children presented to our Accident and Emergency Department between 11:00 and 19:00 h. Most fractures were extension type, mainly Gartland type II and III. Less than 2% were open fractures and neurovascular deficit was seen in 4% of cases.

Seventy-one percent of children who required operative intervention were taken to theatres on the day of admission. Most of the operations were performed by Specialist Registrars (75%). Fixation was achieved by crossed K-wires in 85% cases. Open reduction was necessary in 22% cases. Of the patients who had ''out of hours'' operations, 6% had anaesthetic difficulties such as prolonged intubation.

Post-operative neurological deficit was seen in 3% but only 1% required exploration of the ulnar nerve. The majority of patients were discharged within 48 h of surgery. Four per cent of patients had long-term deformity (3% due to malreduction and 1% due to growth arrest) but corrective surgery for functional limitation was required in only 1%.

Conclusion: An aggressive approach to achieving accurate reduction and stabilisation of these fractures is justified by the low incidence of long-term deformity and neurological complications. Most of these fractures occur during the day and could be dealt with safely on ''twilight'' operating lists without breaching CEPOD recommendations.

Spinal cord injury with vertebral trauma: need for defined management protocol in developing countries

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Introduction: Spinal cord injury with vertebral trauma is a devastating problem. Due to the high cost involved and the lack of a standard protocol for management, most patients of spinal injuries are denied the benefits of efficient early management in developing countries.

Materials and methods: A prospective study was conducted in which 40 patients of acute spinal cord injury with vertebral trauma (C1 to L1 level, injury admission interval $<$10 days) were treated and followed up under a fixed protocol of management, which included initial trial of conservative management and surgery was performed for defined indications.

Fifteen patients who reached the hospital within 24 h of the injury received high dose methylprednisolone (modified NASCIS-II protocol) and were grouped as MP group. The rest 25 patients who presented late did not receive methylprednisolone and were grouped as Non-MP group.

Results: There were 28 males and 12 females. Majority (26) were fall from height. The results were calculated in terms of neurological outcome (change in Frankel grade), bladder function and complications at 6 weeks and 24 ± 4 weeks follow-up. At 6 weeks, there was no significant difference in the neurological outcome between MP and Non-MP group ($p = 0.87$). At 24 ± 4 weeks the MP group had statistically significant neurological recovery ($p < 0.05$). MP group had improved bladder function. There was no significant difference in complications in MP and Non-MP group.

Conclusion: The role of early management of spinal injuries in optimising the outcome is well established. In our study, patients who received MP showed better neurological outcome. We believe that this management protocols should be instituted in developing countries to improve the outcome of spinal injuries.

A prospective study of trauma calls conducted at a district general hospital

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Aim: To establish the appropriateness of the trauma calls put out in a District General Hospital.

Material and methods: We studied 40 trauma calls conducted at William Harvey Hospital, Ashford from February 2002 to August 2002. We collected the information of these trauma patients from the daily trauma meetings and medical records. The majority of the trauma victims were men (35/40). The most common mechanism of injury was road traffic accident.

Results: Amongst 40 trauma victims, 15 patients had musculoskeletal injuries, 8 patients had head injuries and others 17. Amongst 15 musculoskeletal injuries 9 patients have undergone emergency surgeries. Amongst 40 patients 13 patients were admitted to orthopaedic ward, 8 cases to ITU, 6 cases to surgical ward, 4 cases were discharged home from A&E itself. The involvement of clinical teams in the trauma calls were noted as follows: orthopaedic 87.5%, surgical 90%, anaesthesia 80%, A&E 50% and paediatrics 12.5%.

Conclusions: Inappropriate trauma calls lead to wastage of their invaluable clinical time of the

trauma team. Considering the vehicular checklist enlisted criteria only 27 out of 40 trauma calls were found to be appropriate. Ten patients had minor or no injuries out of which four patients were seen and discharged home from the A&E itself. A&E team is involved in only half the trauma calls.

Recommendations: We recommend that A&E doctors are to be involved in the management of all trauma calls. During this study period the trauma cases were managed without a trauma team leader, which was contrary to the ATLS guidelines. Hence, we believe that there should be a trauma team leader for every trauma call. It is advisable to have certain fixed criteria for trauma team activations.

Radiological outcome of volar locking plate versus manipulation and K-wire in treatment of dorsally displaced distal radius fracture

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Purpose: To compare the radiological outcome and radiological score of two groups of patients treated for dorsally displaced distal radius fractures, by manipulation under anaesthesia and K-wire fixation versus volar locking plate.

Methods: We reviewed retrospectively two groups of patients treated during a period of 12 months at our centre for dorsally displaced distal radius fracture using volar locking plate or manipulation and K-wires. Standard radiological fracture parameters were measured until fractures showed radiological union.

Results: We evaluate 41 distal radius fractures treated with volar locking plate and 24 patients treated with MUA and K-wires until radiological union (mean 10 weeks). In the volar locking plate group there were 10 extra articular fractures (8 A3, 2 A2) and 31 intra-articular fractures (4 C1, 15 C2, 11 C3). At union, in the locking plate group, mean radial inclination was 19° mean loss of radial length was 2 mm and the mean volar tilt was 3°. There were no cases in which either the plate or screws failed nor was there any movement of the locked screws in the plate. There was significant loss of reduction in two cases 4.8%. In both cases a significant gap in the dorsal cortex was present at the time of fixation.

In the MUA and K-wires group there 10 extra articular (seven A2, three A3) and 14 intra-articular (three B1, eight C1, three C2). At union, mean radial inclination was 21°, mean loss of radial length was 2 mm and the mean volar tilt was 4°. There was significant loss of reduction in five cases; all of the five cases were intra-articular fractures.

In the volar locking plate group we used bone substitute (Allomatrix TM) in 17 cases. Mean volar tilt differed between the groups being, 2° without bone substitute and maintained at 5° in the bone substitute group. There no difference in the radial inclination or the radial length comparing the two groups.

Conclusions: Treatment of dorsally displaced distal radius fracture using volar locking plate provide a stable fixation for dorsally displaced distal radius fracture and it is superior to MUA and K-wires in maintaining reduction in intra-articular fractures. In the presence of severe dorsal comminution, bone substitute is an important factor in maintaining the volar tilt.

Use of fluoroscan (mini C-arm) in orthopaedics

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An ''action on orthopaedic'' project proposal led to an approval of £60,000 grant to improve Trauma & Orthopaedic efficiency. We purchased a Fluoroscan® Mini C-arm to avoid the need for an attendant radiographer and minimise radiation exposure.

Aim: The aim of the study was to assess the use of Fluoroscan® Mini C-arm (FMC) intensifier in clinic and theatres and compare its use with conventional image intensifier between March and November 2003.

System	Comparative skin radiation dose			
	Perspex (cm)	kV	Field size (cm)	Skin dose rate (mGy/min)
Siemens	5	57	15	1.55
Fluoroscan®	5	49	13.5	0.52

We analysed the type of cases which used the FMC and conventional mobile image intensifier. We also looked at the ease of use and practicality of the FMC.

Results: The FMC was used in 112 cases, while the siemens mobile was used in 248 cases. The FMC was used most commonly for foot, ankle and wrist screenings. The FMC was used almost equally in theatres and clinic. All the operators found the FMC very user friendly.

Conclusions: The FMC is an easy to use mobile image intensifier that can be used in theatres and

clinics for imaging of the distal appendicular skeleton including the elbow and knee.

The FMC radiation dose is about the third compared to the conventional image intensifier.

The FMC is cheaper to buy and run than a conventional image intensifier.

The FMC is run by the surgeon himself, which entails undertaking a short training programme to operate the machine. This would mean freeing up the radiographer for other work in the Radiology Department.

We believe that FMC should be available in each Orthopaedic Department, as it will help cut times in clinics and improve efficiency in theatres.

The effect of intra-articular fracture line orientation on articular loading, wear and fracture healing: an in vitro and in vivo study

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While numerous papers have evaluated prognostic variables following intra-articular fractures, to our knowledge none have examined the effect of intra-articular fracture alignment. We hypothesised that articular step-offs perpendicular to the plane of motion of the joint would result in a poorer outcome than those which lay parallel.

We developed a novel medial femoral condyle fracture model to compare coronal and sagittal articular step-offs, with outcome being assessed in terms of articular surface wear and fracture healing. The study incorporated both an in vitro and in vivo model.

The in vitro study demonstrated notable qualitative differences in loading patterns. A broad area of increased pressure was noted in coronal specimens while sagittal specimens gave rise to a longer narrower area of increased pressure. No significant difference in overall mean transarticular pressure was noted, but the menisci were noted to play a significant role in pressure dissipation ($p < 0.05$). Tibial surface wear was greatest in the sagittal group ($p = 0.04$), followed by coronal specimens with least wear occurring in control specimens. Surprisingly, minimal tibial or meniscal wear was noted in the in vivo experiment. On the femoral side of the knee, the healing response of the femoral osteotomy was significantly better in sagittal than coronal test specimens ($p < 0.05$).

The major factor-affecting outcome following intra-articular fractures appears to be the abnormal shear, compressive and tensile stresses occurring across the articular surfaces. The continuous high shear forces generated at the tibial articular surface, due to the sagittal step-off, incurred increased wear. The tensile strain generated within the coronal intra-articular femoral osteotomy inhibited the healing response.

These findings underline the importance of anatomical reduction and rigid fixation of articular fractures and warrant further work to develop rational classification systems, which would allow greater understanding of which fractures will incur a poor prognosis and why this should be so.

Epidemiology and distribution of human bites: spotting the undeclared injury

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Patients withhold a history of human bite injury (HBI) for various reasons. HBIs carry potentially serious infective risks. A knowledge of the epidemiology and anatomical distribution of HBIs is crucial to spot the undeclared HBI. Patients can then be counselled, and receive appropriate management.

One hundred consecutive patients (106 HBIs) presented to our A&E Department, which serves a defined catchment population of 554,000 people, over 171 consecutive days during 2001—2002. Data was collected prospectively, detailing demographics, injury distribution and characteristics, reasons for presentation, and information about patients' adversaries. An exhaustive practice was employed to identify HBIs. Patients with cutaneous wounds were notified of the importance of excluding a HBI by being briefly counselled on the infective implications. This complemented the initial traditional presenting history. Patients who initially withheld their mechanism of injury were noted.

Seventy-seven males and 23 females (mean 27 years old) presented with HBIs, giving an annual incidence of 45.1 per 100,000 catchment population, and an incidence ratio of 3.7 males: 1 female. Incidence was higher in males aged less than 40 ($p < 0.01$). The incidence of ''strike-bites'' was 13.9 per 100,000 catchment population, and 24.7 ''actual-bites'' per 100,000 catchment population. ''Actual-bites'' tended to occur between persons of the same sex ($p < 0.05$). Female assailants tend to bite the upper limb ($p < 0.001$), and males tend to bite the head and neck regions ($p < 0.001$).

A high proportion (38%) of patients withheld the mechanism of HBI until they understood the infective implications ($p < 0.05$). Patients more likely to withhold the mechanism either knew their adversary personally ($p < 0.05$), or presented with already-infected HBIs ($p < 0.01$). Patients who presented later were those: who withheld the history; with infected HBIs ($p < 0.001$); with hand HBIs ($p < 0.05$); and who were unemployed or blue-collar workers ($p < 0.05$). Injuries tended to occur at night (21:00–24:00 h; $p < 0.01$), and on traditional "nights-out" (e.g. Fridays; $p < 0.05$).

	Class 1	Class 2	Class 3	Class 4
Blood loss%	<15%	15–30%	30–40%	>40%
Heart rate BPM	<100	>100	>120	>140
BP mmHg	Normal	Normal	Decreased	Decreased
Pulse pressure	Normal or increased	Decreased	Decreased	Decreased
Resp. rate BPM	14–20	20–30	30–40	>35
Mental state	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic

Testing the validity of the ATLS classification of hypovolaemic shock

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ATLS is an accepted method of managing patients with major trauma. The ATLS manual classifies the degree of hypovolaemic shock in adults. It is not referenced. A simplified version is shown. While ATLS offer this as a guide, their classification is widely used in practice and has been reproduced in other articles on the management of trauma. We tested this against information held in the TARN database 1989–2003. The classes of shock were defined in adults using the heart rate. Median and interquartile ranges (IQR, 25–75%) of systolic blood pressure (SBP), respiratory rate and GCS determined for each class. All physiological data used was that identified as measured on arrival in the Emergency Department.

	Shock class			
	1	2	3	4
Heart rate (BPM)	<100	100–120	121–140	>140
Number	119404	22298	3773	1368
Median SBP mmHg (IQR)	137 (120–154)	140 (129–157)	135 (110–157)	133 (107–160)
Median resp rate BPM (IQR)	20 (16–24)	20 (18–30)	24 (18–40)	22 (18–30)
Median GCS (IQR)	15 (15–15)	15 (15–15)	15 (11–15)	14 (7–15)
Mortality% (95%CI)	4 (4–5)	9 (8–9)	19 (19–20)	26 (24–28)

Conclusion: The blood pressure, respiratory rate and conscious level do not relate to the pulse rate in the way that the ATLS classification of shock would suggest. Increasing pulse rate was associated with increased mortality

Flap and frame—the treatment of grade 3 open fractures by tissue coverage and Ilizarov frame fixation

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Introduction: In treating open fractures some UK centres have recently shifted from Fix and Flap—internal fixation and free tissue transfer (FTT), towards temporary monolateral external fixation, soft tissue coverage and definitive Ilizarov frame fixation—Flap and Frame.

Methods: Open fractures were identified prospectively. After wound debridement a monolateral ex-fix was applied. Soft tissue coverage was subsequently achieved. As soft tissues settled, the ex-fix was exchanged to an Ilizarov frame for definitive fixation.

Results: July 2002–June 2004, 21 grade 3 open fractures in 18 patients were treated by Flap and Frame. Fifteen male, mean age 36. Segment

involved 19 tibias and two femurs. Eight had associated injuries.

Gustilo grade—3A/3B/3C = 6/13/2. Both 3C fractures required amputation.

No bone loss—15 fractures. Three required FTT for soft tissue coverage, most requiring fasciocutaneous flap or split skin graft. Median frame time 160 days. All fractures united.

Bone loss—(mean 9 cm) in six fractures. 5/6 required FTT. Frame time range 180—540 days.

At mean 14 month follow-up only one fracture of 21 had evidence of deep sepsis. One tibia showed 12° malunion. 7/18 patients experienced superficial pinsite infection. One FTT failed in a grade 3C fracture, leading to early amputation.

Conclusions: Grade 3 open fractures remain a significant treatment challenge, particularly those with bone loss.

Deep sepsis rate of 1/21 fractures treated by Flap and Frame compares favourably with other series. In the 15 without bone loss, union times also compared favourably. Unlike other series, most fractures did not require FTT, as there was no internal fixation device at the fracture site requiring coverage.

Flap and Frame appears to be a very satisfactory method of treating grade 3 open fractures, with low deep sepsis rate, high union rate, satisfactory times to union, and reduced requirement for FTT.

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